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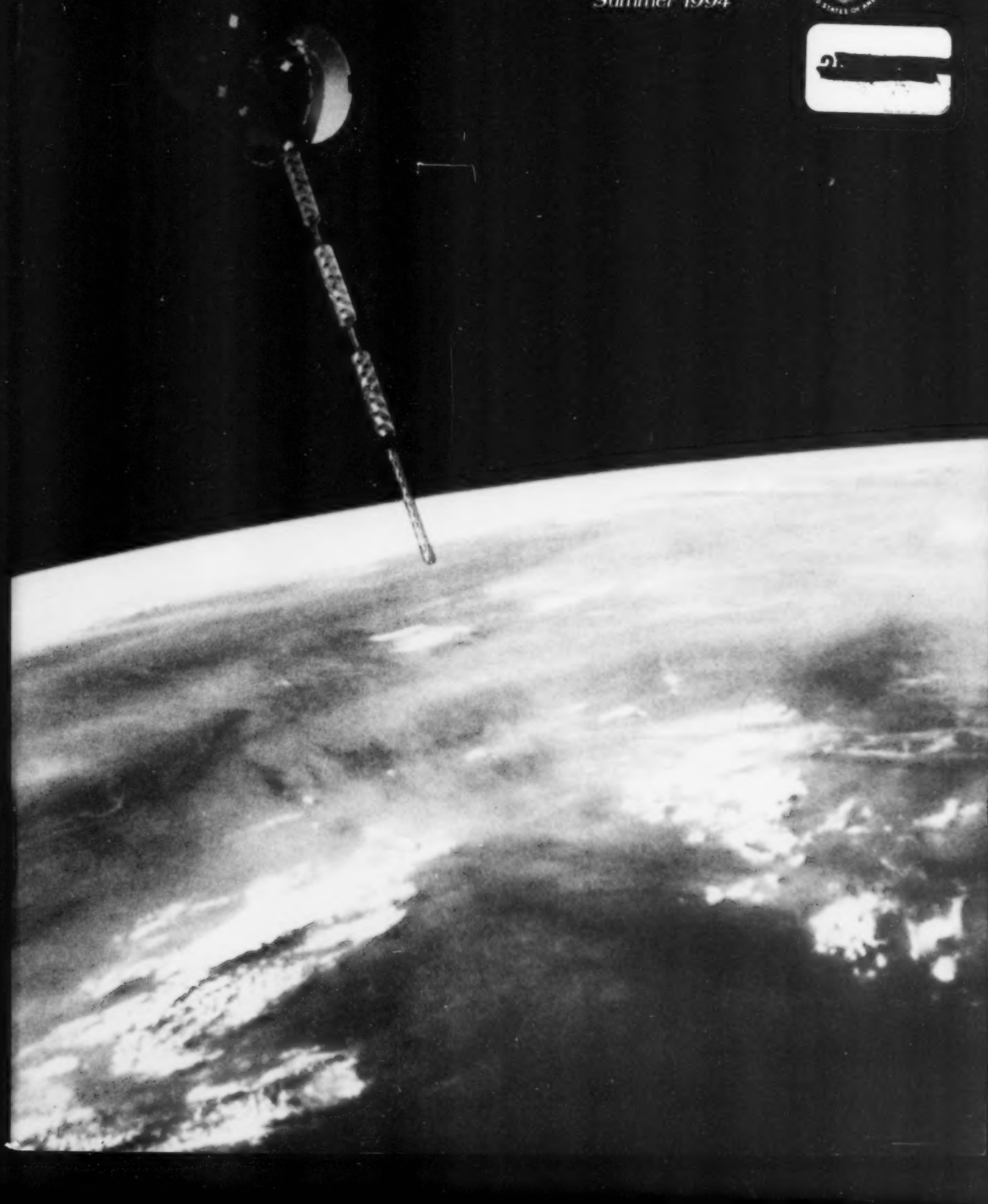
Mariners Weather Log

Summer 1994



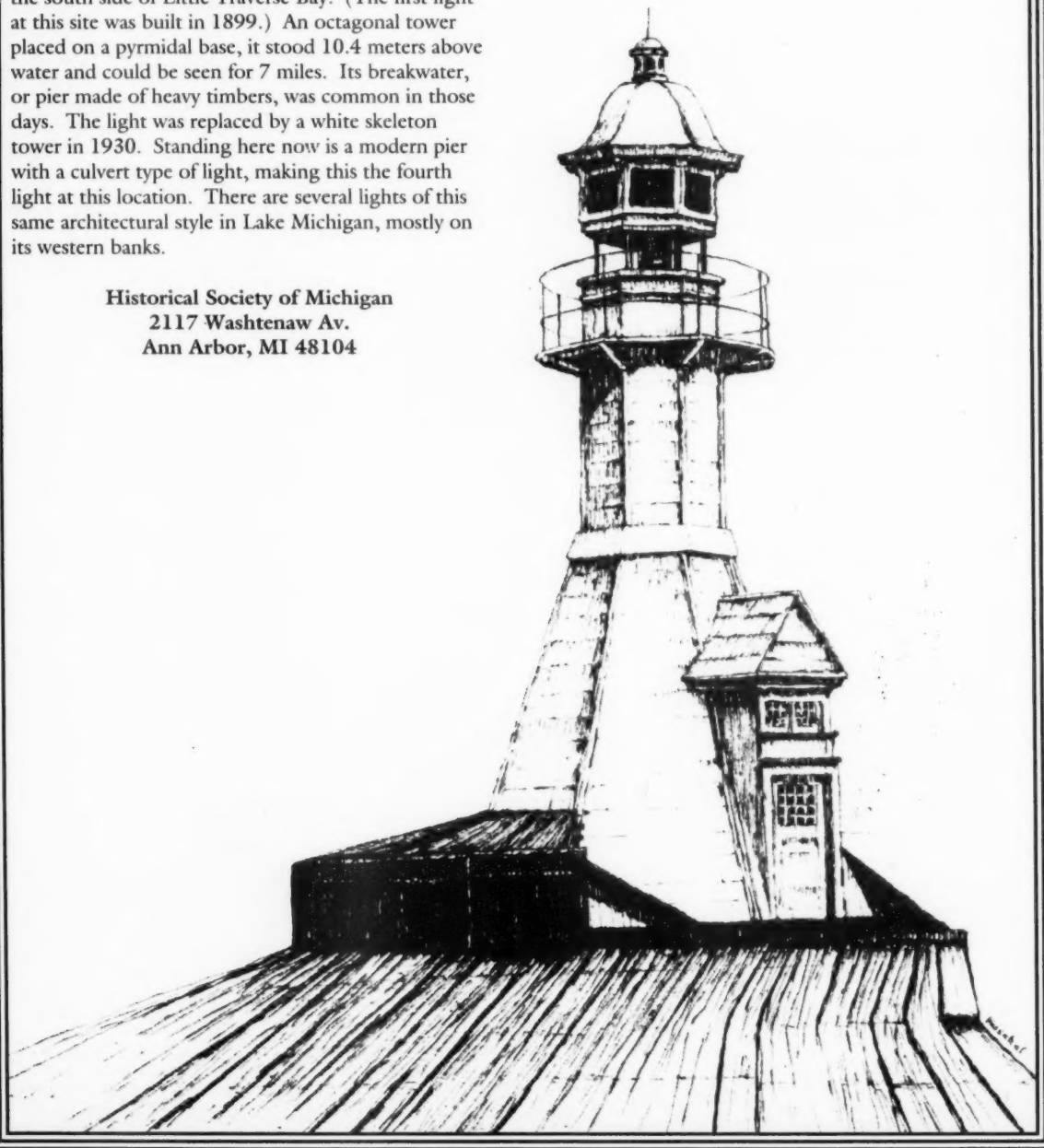
Petoskey West Breakwater Light

Lake Michigan
Petoskey, Michigan

Pen and Ink Drawing by Leo Kuschel
Descriptive passage by Leo and Sue Kuschel

This light, built around 1912, was located at the south side of Little Traverse Bay. (The first light at this site was built in 1899.) An octagonal tower placed on a pyrmidal base, it stood 10.4 meters above water and could be seen for 7 miles. Its breakwater, or pier made of heavy timbers, was common in those days. The light was replaced by a white skeleton tower in 1930. Standing here now is a modern pier with a culvert type of light, making this the fourth light at this location. There are several lights of this same architectural style in Lake Michigan, mostly on its western banks.

Historical Society of Michigan
2117 Washtenaw Av.
Ann Arbor, MI 48104



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Cover: Stylistic view of ORBCOMM Low Earth Orbit (LEO) communications satellites. They are scheduled for commercial service by January 1995. Courtesy of Orbital Communications Corp. (ORBCOMM).

Inside Back Cover: Grace Darling's quiet beauty resonates through the ages in this portrait by Henry Perlee Parke (1838). At 22 years of age, she captured the British Public when news of her heroic lifesaving effort was known. She died at the age of 26 of tuberculosis.

Back Cover: A crisp, test sector image from the new GOES 8 NOAA satellite shows the view from the Outer Banks to Long Island. GOES 8 is scheduled to be fully operational by October 1994. Courtesy NESDIS.

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Mariners Weather Log

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Communications

The heart and soul of the VOS program and, in fact, the marine weather program is communication. In this issue we take a look at the past, present and future in weather communications. We would like to dedicate this issue to the Radio Officer, and in particular the *first radio officer*– Guglielmo Marconi.

Marconi, who most people associate with the invention of the radio, was the father of radio telegraphy. While he had no formal scientific training he was able to best some of the top minds of the day, including Hertz, Popov and Branly. While auditing a physics course at the University of Bologna in the summer of 1894, he learned about the work of Hertz on electromagnetic waves. "An ardent amateur of electricity," as he later described himself, Marconi split his time in the winter of 1894-95 between the university and his attic room, where he started his own experiments. By the summer of 1895 he had not only reproduced the work of his contemporaries but improved upon it by carefully redesigning all components. He quickly discovered that an elevated transmitting antenna and good ground gave the best results. In September of 1895 he was able to show the world that these "Heretzian waves" not only traveled in straight lines like light, but reached over hills. The British quickly realized the implications of Marconi's discovery and had him set up a permanent installation on the Isle of Wight transmitting to Bournemouth. A demonstration was also rigged for Lloyd's of London from the lighthouse on Rathlin Island, off the Irish coast, where the first sights of approaching transatlantic steamers are made, to a mainland telegraphic office 12 kilometers away. America soon beckoned and Marconi traveled to the U. S. to report on the America's Cup race for the New York *Herald*. There was also a demonstration for the U. S. Navy involving several ships. But on December 12, 1901 in Newfoundland, after much work, Marconi received the first transatlantic message from Cornwall and became a legend.

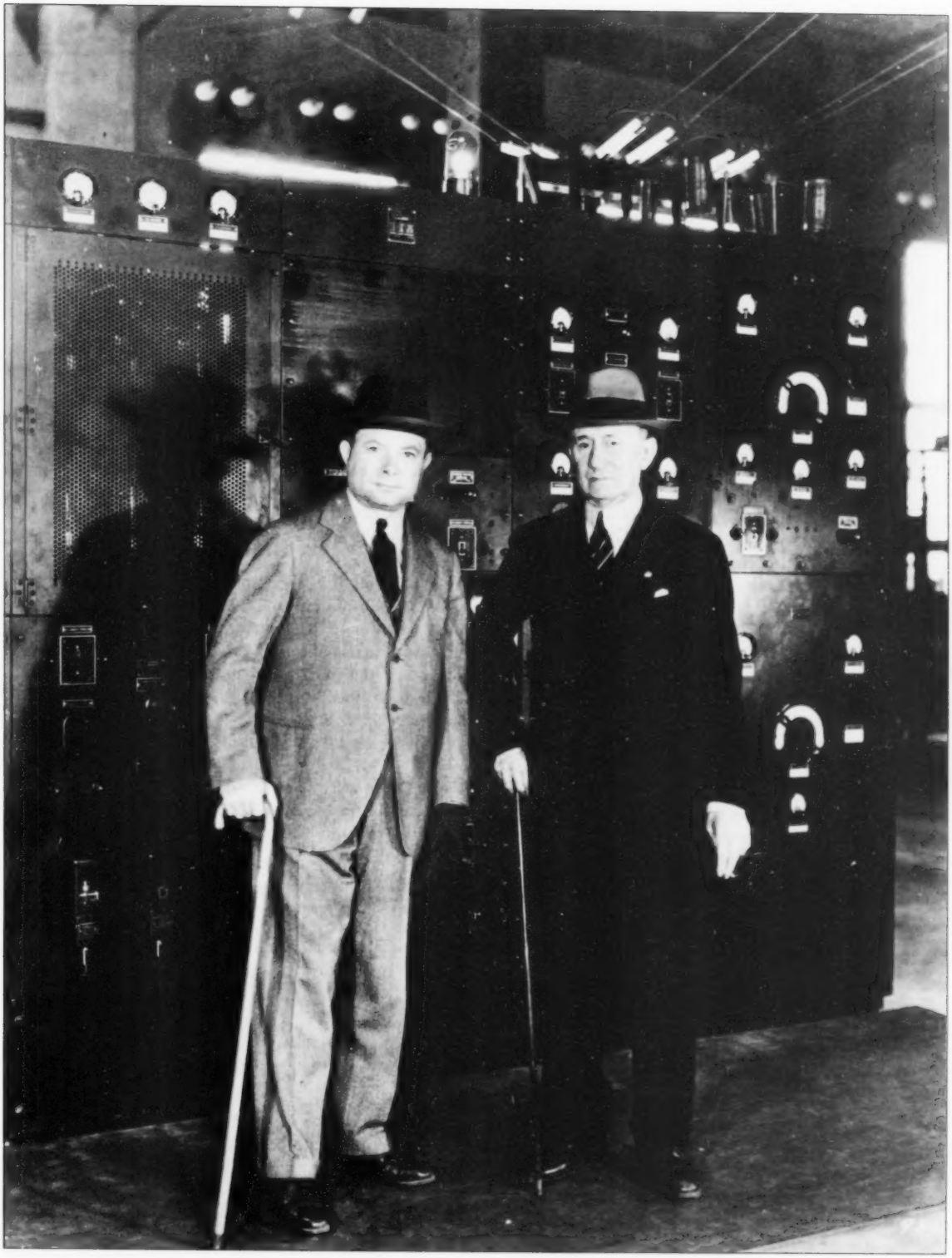
The Weather Bureau was the first government agency to adapt this new and promising communications medium and from 1901 to 1902 conducted wireless tests between Hatteras and Roanoke Islands in North Carolina.

A Great Britain Meteorological Committee report of March 1909 reads: "The first month of the experimental period closed 28th February. During the month 469 reports were received from 43 ships ... . The observations were, for the most part, good."

And the rest, as they say, is history.

–Editor

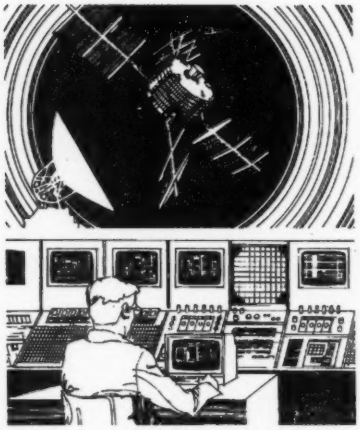
The gelatin silver print on page 3 is David Sarnoff (left) and Guglielmo Marconi taken in 1933. It is printed courtesy of the National Portrait Gallery, Smithsonian Institution; gift of Erik Barnouw. The connection between Sarnoff and Marconi is an interesting one. On April 15, 1912 the wireless message "SS ***Titanic*** *ran into iceberg. Sinking fast" was picked up accidentally by Russian-American wireless operator David Sarnoff, 20, who was manning a station set up by John Wanamaker in his New York store window as a publicity stunt. Sarnoff relayed the message to another steamer which reported that the liner had sunk, but some survivors had been picked up. President Taft ordered all other stations to remain silent and Sarnoff remained at his post for 72 hours, taking the names of survivors and making his own name familiar to millions of newspaper readers. David Sarnoff became a radio and television pioneer founding NBC in 1926.*



THE BLACK HOLE—

OR WHERE DO THOSE WEATHER OBSERVATIONS GO?

John MacDonald
National Weather Service



Metro Creative Graphics

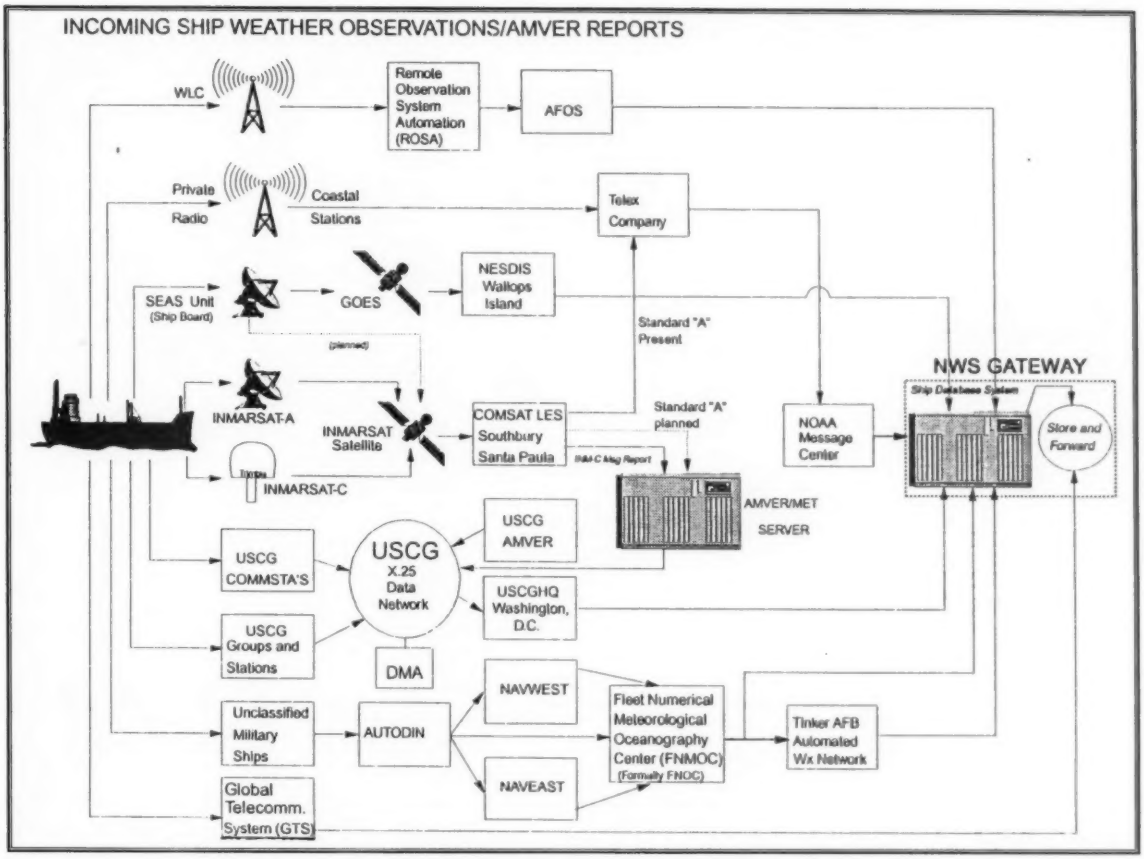
While you are reading this, someone, somewhere at sea is preparing a formatted weather observation to be sent to the National Weather Service (NWS). Several questions frequently arise: What happens to the observation? Where does it go? Is it ever seen again?

These encoded weather messages, transmitted every 3 or 6 hours, result in a stream of up to 1400 observations each day that winds its way to marine forecasters worldwide via the Global Telecommunications System. They are also entered into the National Meteorological Center's (NMC) numerical models of the ocean and atmosphere for the production of forecast guidance products and are archived by NOAA's National Climatic Data Center and National Oceanographic Data Center. The observations are also used by the Navy's Fleet Numerical Meteorology Oceanography Center (FNMOC) computer models. These observations are transmitted to shore, routed to NWS, processed, counted and distributed to the world. And these numbers do not include the informal Mariner Reports (MAREPs) transmitted to cooperative coast radio stations such as those in Alaska, Washington and Delaware who then forward these reports to the local NWS forecast office.

All ships know the first step is to send the weather observations to shore. Commercial radio stations such as KFS World Communications in California and Louisiana, WLO Mobile Marine Radio in Alabama, U.S. Coast Guard Communications Stations and Groups, and a little known station, WLC Central Radio, in Rogers City, Michigan, receive observations and forward them to the NWS. WLC Radio is unique in that it serves only the Great Lakes area. Once the weather observation is received by WLC, it is entered into the Remote Observation System Automation (ROSA), a store and forward computer that is linked with the NWS Automation of Field Operations and Services (AFOS) communication system. AFOS then forwards information gathered by ROSA to the NWS Gateway Ship Database System in Silver Spring, Maryland. Ultimately, all weather messages will make an intermediate stop at this Gateway prior to distribution to forecasters, numerical computer models and archiving centers.

Weather observations transmitted to other private coastal radio stations take another path to the NWS Gateway. The observations are prepared in a different format—one that can be read by a telex company—and forwarded to the NOAA Message Center which is also located in Silver Spring, Maryland. The Message Center delivers the observations to the Gateway where they are entered into the Ship Database System for processing. Several ships in the maritime community have become part of a program with the National Ocean Service (NOS) and NWS whereby they are equipped with Shipboard Environmental [Data] Acquisition system (SEAS) computer units. The SEAS unit receives, stores and transmits meteorological and oceanographic data quickly to NOS and NWS using the Geostationary Operational Environmental Satellite (GOES) data link. The data are telemetered to NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) at Wallops Island, Vir-

John MacDonald is the Marine Telecommunication Program Manager of the National Weather Service. Please contact John McDonald at NOAA NWS SSMC2 W/OS0151, Station 17406, 1325 East-West Highway, Silver Spring, MD 20910 or at 301-713-1931 if you have any questions or comments.



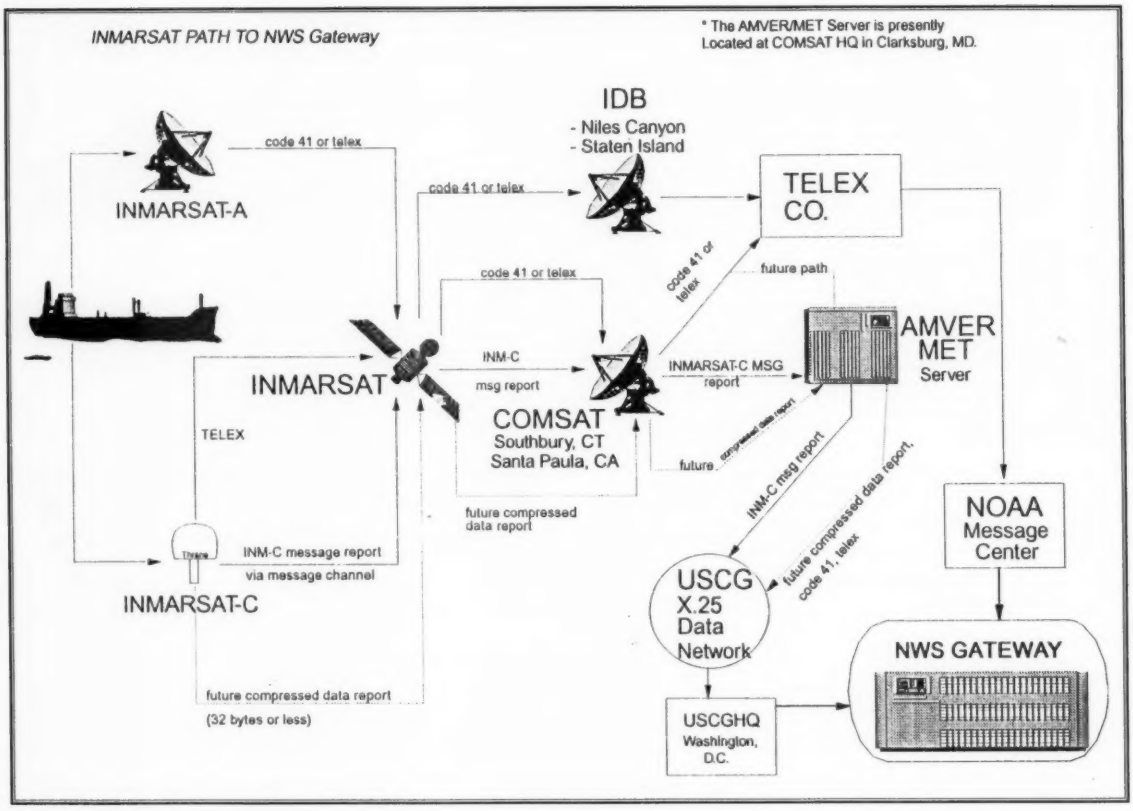
When your weather observation leaves your ship it ends up at the NWS Gateway, but it may get there by a variety of different routes which are dependent upon your initial choice of transmission.

While tracing the route of the messages is extremely complex, the observation can reach the marine forecaster as quickly as 1.5 minutes after it is sent by the observer.

ginia. The data are then sent to the NWS Gateway for further distribution. Future plans for SEAS include re-routing the observations to INMARSAT satellites and then to the NWS Gateway via COMSAT and the U.S. Coast Guard. This path may save money, and improve the reception of U.S. Coast Guard Automated Mutual Assistance Vessel Rescue System (AMVER) Program position reports. Presently unclassified military ships send weather traffic to Naval Communications Stations around the world by high frequency (HF) radio. This is changing as the military is moving to satellite communications. Once a weather observation is received, the message is forwarded via the Automated Defense Information Network (AUTODIN) to Commands at NAVWEST, NAVEAST, and FNMOC where all information from military ships at sea are integrated for the formation of weather forecasts in support of military operations. The unclassified information is then forwarded to both the NWS Gateway and Tinker Air Force Base Automated Weather Network in support of U.S. Air Force operations.

The more complex, yet cost effective, portions of the weather observation delivery system are the U.S. Coast Guard paths via their Communications Stations (COMMSTAS), Groups, and Stations, and the INMARSAT/COMSAT path. The Coast Guard receives weather messages from deep draft ships, small fishing vessels, and local mariners. The COMMSTAS receive information via HF radio while the Groups and Stations receive information via Very High Frequency (VHF) radio. Weather observations are then entered into the USCG Data Network where they are delivered automatically to the NWS Gateway via USCG Headquarters in Washington, DC.

The largest percentage of weather message traffic comes by way of satellite. This includes



Observations that are sent via INMARSAT are among the most cost effective. These now comprise the bulk of weather messages and they are also useful as AMVER position reports by the U.S. Coast Guard.

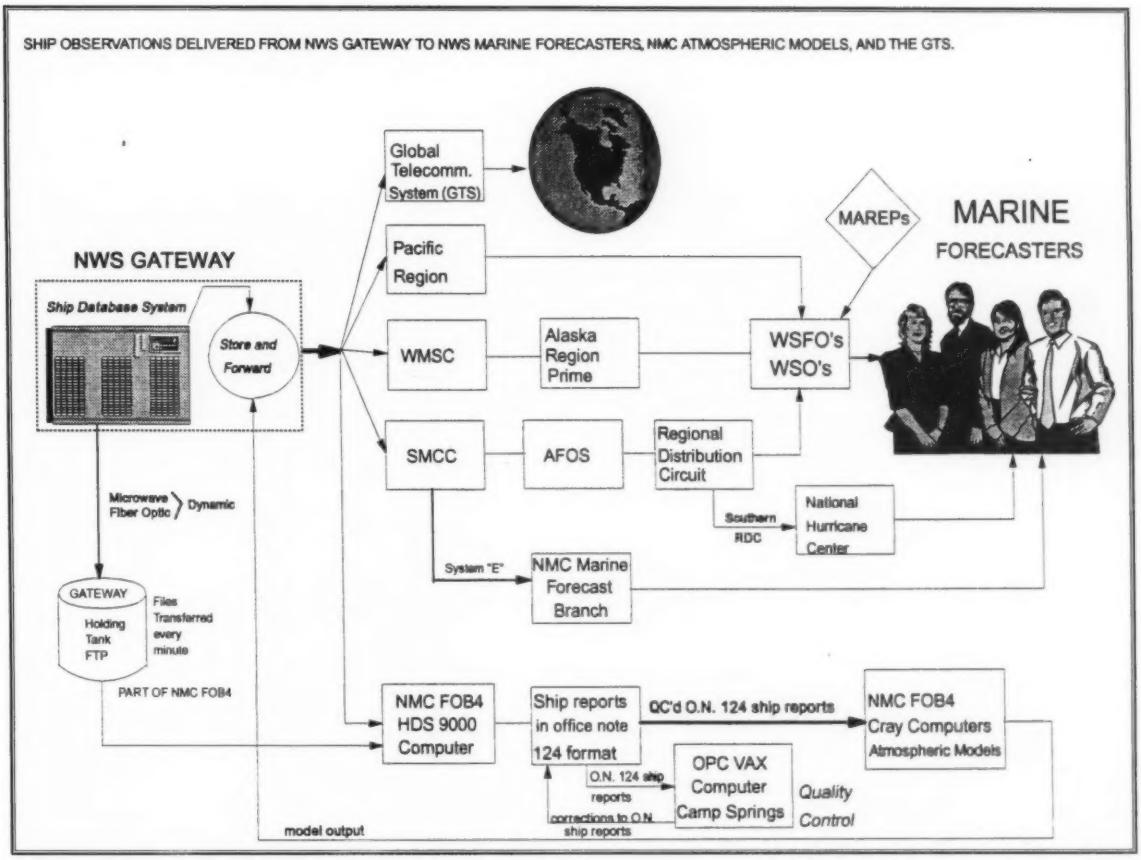
INMARSAT Standard "A" and Standard "C" which provide a computer generated acknowledgement for the receipt of message. The Standard "A" and "C" weather observations are up-linked to the INMARSAT satellite. The "A" message in the system will be down-linked to COMSAT or IDB Mobile depending on how the shipboard code 41+ is configured. COMSAT, or IDB, then forwards the message in a telex format to the appropriate Telex company who, in turn, forwards the information to the NOAA Message Center which delivers it to the NWS Gateway.

COMSAT also forwards weather observations to the USCG AMVER Server to convert weather observations from AMVER program participants into AMVER position reports. The server then forwards the messages to the AMVER Operations Systems Center (OSC) in Martinsburg, West Virginia by way of the USCG X.25 Data Network. The converted weather observations provide an alternate means for AMVER participants to deliver Position Reports to the USCG and promises to offer a cost savings to the U.S. Government and hopefully increase participation in both the AMVER and Voluntary Observing Ship (VOS) Program. In the not too distant future, all Standard "A" weather messages sent to COMSAT will go to the AMVER/MET Server, thereby reducing the cost for receipt of messages.

Messages sent to other authorized weather collection facilities worldwide are forwarded to the NWS via the GTS. The GTS was developed by the World Meteorological Organization (WMO) for the global exchange of observational information and processed information including warnings and forecasts.

From this point on, all the weather messages go into the "number cruncher" and return to the mariner in the form of marine weather warnings, forecasts, and radiofacsimile weather charts that are prepared by NWS marine forecasters.

Ship weather observations from all sources,



The NWS Gateway consists of two store and forward areas. The first is for incoming messages and the second is for outgoing forecasts. Before the weather observations go any farther along in the chain, they are sent to NMC for quality control.

except for those received on the GTS, are entered into the Gateway's Ship Database System where they are placed in collectives and delivered to the Gateway's store and forward area. Ship weather observations received on the GTS go straight to the store and forward area without a stop in the Ship Database System. At the Gateway there are two store and forward areas. The first is for incoming messages and the second is for outgoing forecasts. The incoming messages are placed in the "holding tank" and are forwarded to an HDS 9000 computer at the National Meteorological Center. Here they are reformatted into Office Note 124 format. A VAX computer checks to ensure all fields are valid. For those that are not, a correction is made to the format. The now quality controlled (QC'd) ship reports are ingested into the Cray mainframe computers to play an essential role in the generation of forecast model guidance of future atmospheric and oceanographic conditions. The model guidance is then transmitted back to the NWS Gateway for distribution to regional Weather Service Forecast Offices; the National Hurricane Center in Miami, Florida; the NMC Marine Forecast Branch in Camp Springs, Maryland; the National Severe Storms Forecast Center in Kansas City, Missouri; and a host of other public and private facilities.

Finally, in near real-time, forecasters review the model output, available weather observations, weather radar information, and satellite imagery, and prepare marine warnings, forecasts and weather charts for broadcast back out to the VOS ships that somewhere at sea, somewhere in the world, are preparing weather observations that begin the process all over again.

Weather Dampens Sydney to Hobart Yacht Race

Kenn Batt and John James
Australian Bureau of Meteorology

The 1993 Sydney to Hobart Yacht Race proved to be one of the most demanding in history thanks to hurricane force gusts and 10-meter seas generated by a potent summertime Low. Headwinds prevailed for most of the race, with spinnakers only being used for the first and final few hours. Of the 104 yachts that started, only 37 crossed the finishing line.

Starting every year on 26th December, the race is one of the major highlights of the Australian sporting calendar. From Sydney, the state capital of New South Wales to Hobart, the capital of the island state of Tasmania, the race covers 630 nautical miles (1,167 kilometers) through the Tasman Sea and eastern Bass Strait– some of the roughest waters in the world.

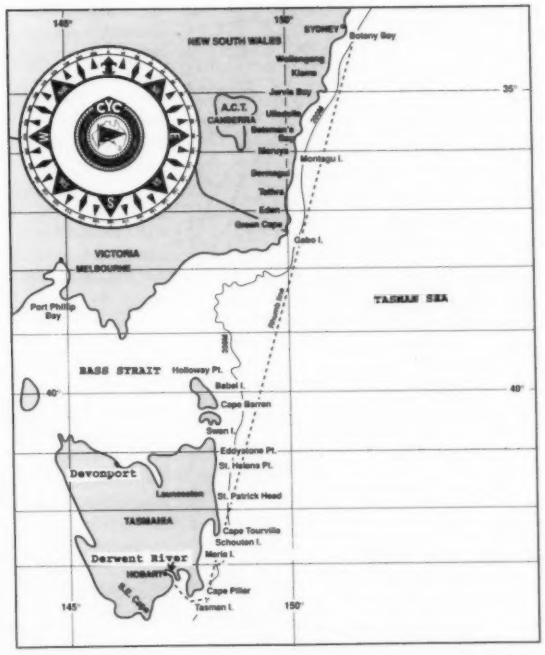
More than 100 ocean racing yachts from around the world usually participate. Their lengths range from a compact 9.5 meters to the 25-meter maxi-yachts. The race record is 2 days, 14 hours, 36 minutes and 56 seconds set by the American maxi ketch ***Kialoa*** in 1975. Usually, most of the fleet reaches Hobart for a New Year's Eve celebration.

This year a low pressure system developed during the first day over eastern Bass Strait and maintained a central pressure of about 992 millibars for the following 3 days before moving south southeastward and weakening.

Pre-Race

The New South Wales Regional Office of the Australian Bureau of Meteorology provided the pre-race briefing to the yacht crews and media on Fri-

Kenn Batt and John James are meteorologists at the Regional Forecasting Centre, New South Wales Regional Office, Australian Bureau of Meteorology, Sydney, NSW, Australia.



Some of the fleet of 106 yachts can be seen at the start of the Sydney to Hobart Yacht Race (left). Photograph by Ian Mainsbridge. Above is the 630-mile race course marked off by the rhumb line. Tasmania was discovered and named Van Diemen's Land in 1642 by Dutch navigator Abel Tasman and was renamed in 1853. The Tasman Sea stretches between southeastern Australia and western New Zealand.

Bottoming out- the Low had reached its minimum pressure of 992 millibars in this infra-red satellite cloud image at 0000 UTC December 28, 1993 (below). Note the clockwise circulation of the Southern Hemisphere extratropical cyclone. Image taken by the Japanese Geostationary Meteorological Satellite.

day, December 24th, 2 days prior to the start. This attracted greater interest than normal as the Bureau had informed the organizers of the race that numerical computer models were suggesting that a significant low pressure system would develop during the course of the race.

The following 2 days saw the crews undertaking preparations for what looked to be a very rough trip. The possible development was of even greater interest to one of the authors (Kenn Batt) as it was to be his second Sydney to Hobart race. He was a crew member and the weather forecaster on the eventual International Offshore Rule (IOR) handicap winner, ***Solbourne Wild Oats***.

The following is a brief chronology of events:

Day One – Sunday, December 26th

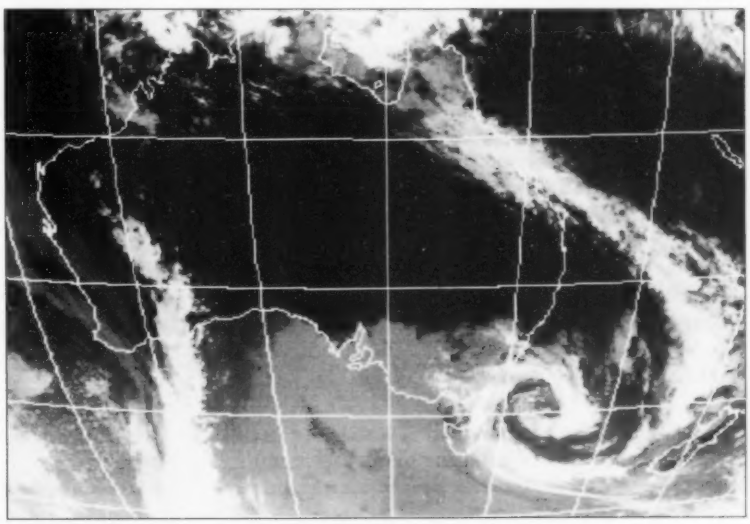
The race began at 0200 (1300 Local) in a 12-to 15-knot northeast sea breeze which persisted into the late afternoon. A thunderstorm then moved over the race area followed by a period of light and variable winds for about an hour, ahead of a cold front which brought fresh west to southwest winds. These winds slowly increased in speed to become strong to gale force by early Monday morning.

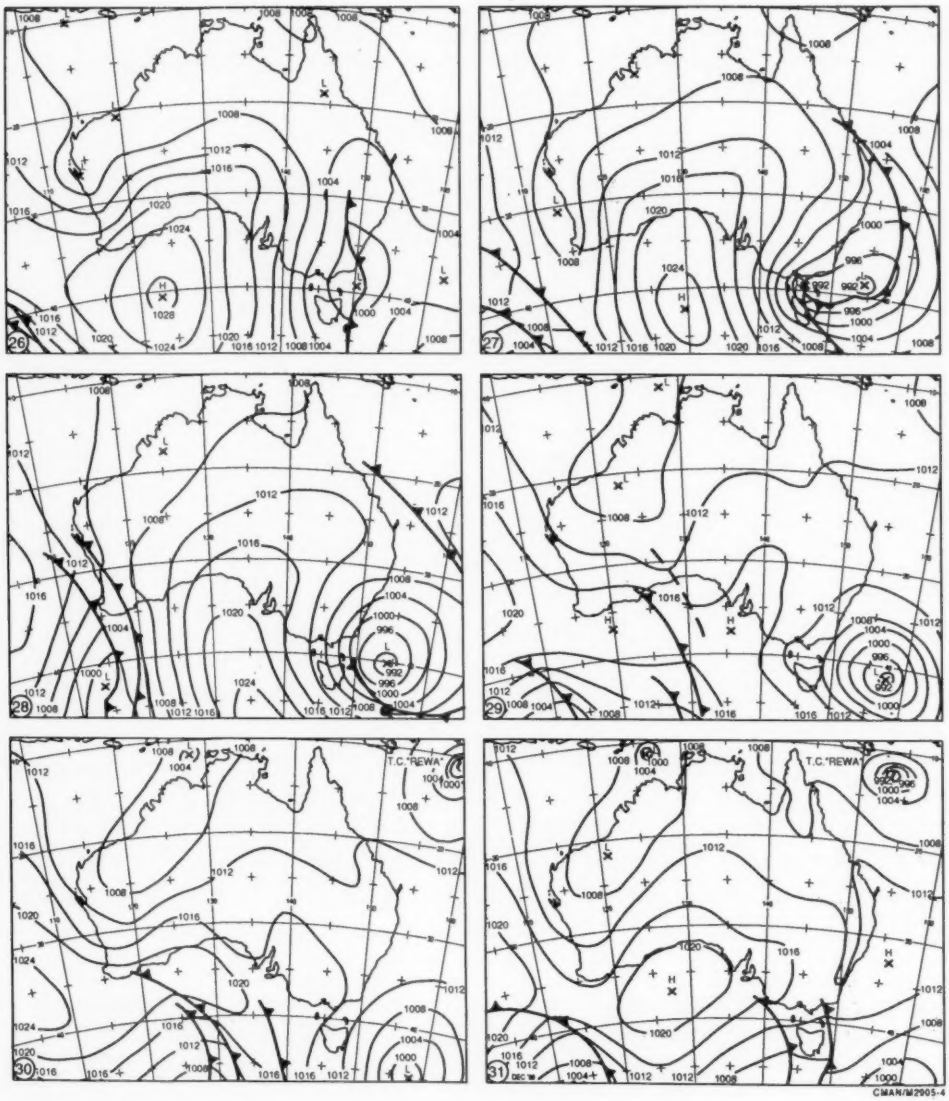
Day Two – Monday, December 27th

By 0000 (1100 Local) the front was located well out in the Tasman Sea with an associated low pressure center of 992 millibars in the southern Tasman Sea. A second center of similar intensity was located a little farther to the west in Bass Strait.

The strongest winds during the day were being reported over western Bass Strait and to the south of the low pressure complex. Because of the strong winds, two other annual yacht races from Melbourne, the state capital of Victoria, to Hobart and Devonport in Tasmania were postponed.

The leaders in the Sydney to Hobart Yacht Race at this stage were well off the southern New South Wales coast and about to enter eastern Bass Strait. The bulk of the fleet was spread out farther northward well off the New South Wales coast and east of the rhumb-line. The fleet was now feeling the full effects of strong to gale force winds which were opposing the southward flowing East Australian Cur-





Evolution of the Tasman Low is depicted to the left by the mean sea level pressure analyses at 0000 UTC from December 26 to 31, 1993. The time sequence reads from left to right with numbers in the lower left hand corner indicating the day of the month.

Under threatening skies the winner (Line Honors) is ***Ninety Seven*** *in 4 days, 54 minutes and 11 seconds. Approaching the finish line* ***Ninety Seven*** *(right) is accompanied by a raft of well-wishers. Photograph by Peter Campbell.*

rent and creating extremely uncomfortable sea conditions with wave heights approaching 10 meters. Yachts bringing up the rear of the fleet were generally closer inshore, receiving some protection from the strong to gale force offshore southwesterlies. However, by evening more than 30 yachts had retired, either through equipment failure or concern for crew safety.

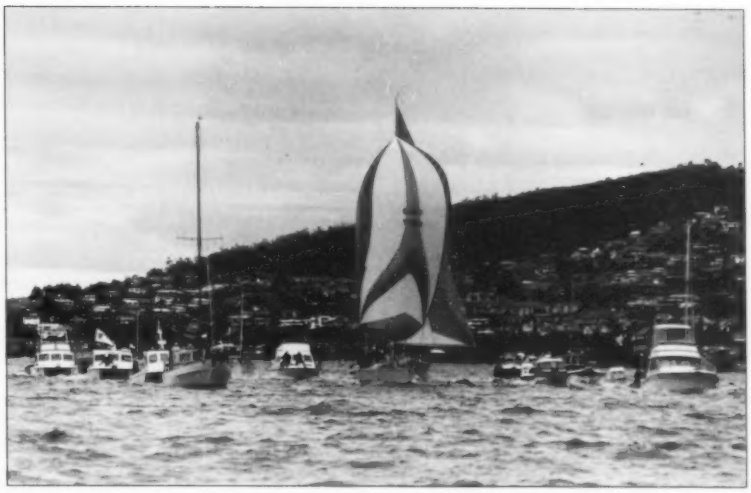
Day Three – Tuesday, December 28th

During the early hours of Tuesday, the Southern Tasman Sea Low had bottomed out at 986 millibars. The second center over Bass Strait was quickly losing its identity. As predicted by the computer models some 4 to 5 days previously, the deepening of the Low had become a reality. This was a result of a dynamic interaction with the upper level flow and the marked surface temperature gradient across the front. Warmer than average sea water temperatures in the area may have also contributed to the deepening.

The Low was quickly becoming cut-off as a high pressure system, west of Tasmania, ridged to the south of the Low toward New Zealand. This forced the Low to remain nearly stationary for the next 24 to 48 hours.

While yachts along the New South Wales coast

were still under the influence of the southwesterly airstream, the race leaders entering Bass Strait were experiencing south to southeast 35- to 40-knot winds gusting in excess of 70 knots. Sea conditions were horrendous. Wave heights at times were over 10 meters with some larger rogue waves being reported. These rogue waves were apparently responsible for some of the worst hull and rigging damage as well as crew injuries sustained by the retiring yachts.



One owner spent 5 hours in the water after being swept off his yacht. Two boats were abandoned by their crews due to fears of sinking. By evening another 32 yachts had retired, bringing the total at this stage to 62. These retirements included all the highly fancied maxi-yachts, such as ***Brindabella***, ***Cassiopeia***, ***Ragamuffin the Maxi*** and ***Amazon***.

Day Four – Wednesday, December 29th

Slowly the wind abated to below gale force by mid afternoon. That night the Low was located near 42°S, 158°E, with a central pressure of approximately 992 millibars. This day saw another three retirements from the race.

Day Five – Thursday, December 30th

The Low, drifting slowly southward, was near 45°S, 158°E at 0000 with a central pressure of 996 millibars. Late in the day, winds weakened to 15 to 18 knots and veered from southeast to south southwest with the southward movement of the Low.

Most of the fleet experienced more comfortable conditions but local effects, such as funnelling through the Bass Strait, caused problems for trailing yachts. The race leader ***Ninety Seven*** (a brand new 14.3-meter yacht) completed the race at 0245 (1345 Local) after 4 days, 54 minutes and 11 seconds at sea. She became the shortest yacht to take line honors since 1953. The second yacht to finish was the 12.2-meter ***Cuckoos Nest***, finishing 2 hours behind ***Ninety Seven*** and took handicap honors in the International Measurement System (IMS) division. Two more boats retired during the day.

Day Six – Friday, December 31st

The Low continued to move toward the south, and was no longer a controlling feature of the weather over the race area. (For the next 2 weeks southeastern Australia remained under westerly winds, which largely contributed to the disastrous bushfires which affected eastern New South Wales for an unprecedented 19-day period.)

The winds became very light and frustrated yacht crews on the last leg of the race up the Derwent River to the finishing line. To add to the problems, heavy rains fell over the Derwent River catchment in the previous fortnight so large amounts of water were racing down the river, enhancing its reputation as a very fickle waterway. On ***Solbourne Wild Oats***, for example, it took an extra 4 hours to reach the finish line at Hobart. In ideal conditions, the trip up the Derwent would take about 2 hours.

Aftermath

Not since the 1984 Sydney to Hobart Race has an intense Low pressure system had such an effect on the race. In that year a record 106 withdrawals occurred out of a fleet of 152 when a 996-millibar Low affected the yachts during the first and second days of the race.

In contrast, the 1993 race with 67 withdrawals (the second highest in the 49 year history of the race), was under the influence of a much deeper Low which persisted until the fourth day of the race.

Although weather conditions were comparable with the tragic Fastnet Race of 1979, not a life was lost. In fact in the history of this race, through some of the roughest water in the World, there has only been one death.

Real-time Oceanographic Data for Ports

Bruce B. Parker
National Ocean Survey

Accurate water level and current information has always been important for ships entering or leaving ports, but since the appearance of deep-draft commercial cargo vessels and oil tankers it has become critical. This information can help avoid groundings and collisions that can lead to hazardous material spills. Modern vessels are so huge that they have to enter U.S. ports near times of high tide, and they are difficult to maneuver and stop.

To avoid groundings a pilot must know how much water is under the keel so he needs accurate water level information, both at that moment and in the near future. To avoid collisions with other ships, or structures, a pilot needs accurate current information, especially when the ship is maneuvering in a channel bend or docking. When two ships approach each other in a narrow channel from opposite directions the right of way is usually given to the ship with the "fair tide," because that ship, moving with the current, has less maneuverability. Accurate current information is critical to giving right of way to the correct vessel.

If an accident leads to an oil spill, accurate current information becomes critical for predicting the movement of the spill. Such data can help minimize environmental damage to the bay or harbor and the resulting economic losses for local fishing and tourism industries. This same knowledge of currents is critical during search and rescue operations when trying to predict the location of someone overboard.

Water level information can also have a significant economic impact. Accurate channel depths allow maximum loading of each ship thus increasing exports of certain types of cargo (e.g. coal, grain, phosphates, etc.) as well as decreasing lightering time and offloading for incoming ships. No matter how many hundreds of millions of dollars are spent on dredging the

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The Need for Water Level and Current Information

PREVENTION OF MARITIME ACCIDENTS AND HAZARDOUS SPILLS
- Prevention of groundings (water levels)
- Prevention of collisions (currents)

MORE EFFICIENT HAZARDOUS SPILL CLEAN-UP OPERATIONS
- Prediction of the movement of the spill (currents)
- Prediction of slack periods for special operations (currents)

EFFICIENT TRADE
- Increased exports– maximum loading of cargo (water levels)
- Decreased lightering time and offloading (water levels)

EFFICIENT SEARCH AND RESCUE (currents)

channels of U.S. ports, maximum economic benefit from these channels requires real-time and forecast water level information.

Tide and Tidal Current Prediction– the Old Fashioned Way

For over a century, the mariner seeking water level and current information has gone to the tide and tidal current prediction tables. Tide predictions were first published in the U.S. in 1830 in *The American Almanac*, and in 1867, as separate tables. Tidal current predictions were added in 1890, and published separately in 1923. These tables, which are published by NOAA's National Ocean Service (NOS), are required to be carried by all vessels of 1600 or more gross tons when operating in navigable waters of the U.S.

Such tables do not tell the mariner what the actual water level or current will be. They can only provide him with astronomical tidal predictions, that is, the portion of water level change or current flow due to the gravitational effects of the moon and sun. The tables do not, and cannot, include the often important effects of winds, river flow, atmospheric pressure, or water density (salinity or temperature) on the water level and currents.

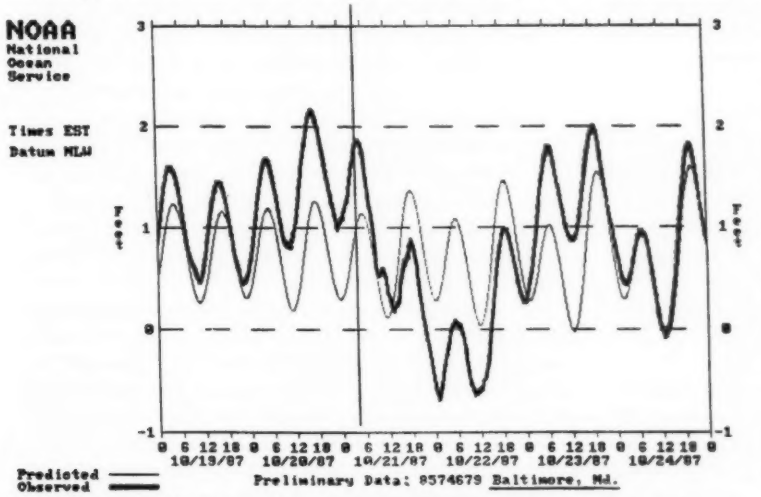
Over the years the tide and tidal current tables have been useful because the astronomical tide generally dominates these other meteorologically generated effects (except during storms), and thus in most cases is a fair representation of the actual water level. Also, the astronomical tide can be very accurately predicted (once a sufficient amount of data has been obtained and analyzed) because of its periodic nature and since the frequencies of the relative motions of the earth, moon, and sun are well known.

One area where the tide and tidal current tables have not been as useful is the Gulf of Mexico, where the tide is often overshadowed by wind-caused changes in water level. However, even in the ports along the East Coast of the U.S., where there is a strong tidal signal, these tables are less useful for the deep-draft vessels for whom every foot of water depth is crucial. These ships need to know the actual water depth, including the nontidal-caused changes.

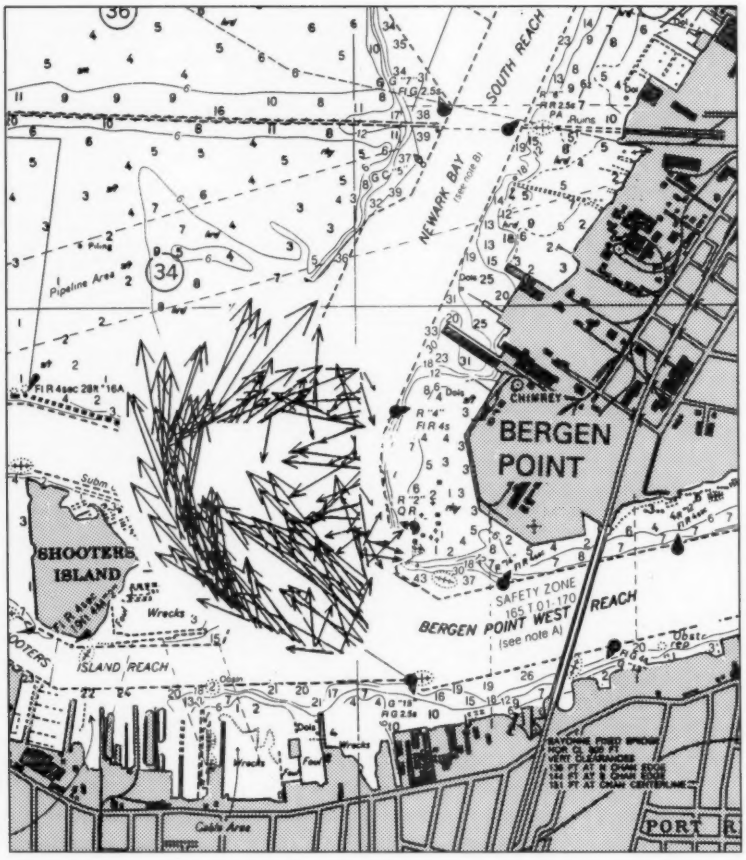
Real-time Systems:–Going Beyond Tidal Predictions

Most of the thousands of locations for which predictions are provided in the Tide and Tidal Current Tables are based on data series from gauges or current meters installed for a finite time period. However, NOS maintains 189 permanently operating water level stations, the National Water Level Observation Network (NWLON). In areas where wind can have a significant effect on water level, actual water level measurements from the gauges at these NWLON stations, provided to the mariner in real-time, would be more valuable than tide predictions alone. Real-time delivery has not been a simple or inexpensive task, but with the recent advances in sensor technology, computers, and telecommunications, such data can now be provided much more easily and in a variety of useful forms.

A prototype program at NOS provided real-time water levels from two dozen specially modified water level gauges to the pilots associations and port authorities in Chesapeake Bay, Delaware River and Bay, the Columbia River, and the Port of New York and New Jersey. The



At left, the cargo ship ***Yorkmar****, in thick fog, is lodged against the Chesapeake and Delaware Canal Bridge. Courtesy of U.S. Coast Guard. Above, is a sample output from the TIDES-ABC (REALDATA) program. The thin line is the predicted tide, while the thick line represents the actual measured water level; differences are due to wind effects on the water level of Chesapeake Bay.*



Chartlet of the Bergen Point area of the Port of New York and New Jersey. Accurate current information is important in the West Reach because right of way is given to the ship with the "fair tide," that is, the ship going with the current, because it has less maneuverability. It is also important in making the turn toward Newark Bay. The arrows show mid-level currents near the time of maximum flood currents and were obtained by towing an acoustic doppler current profiler (ADCP).

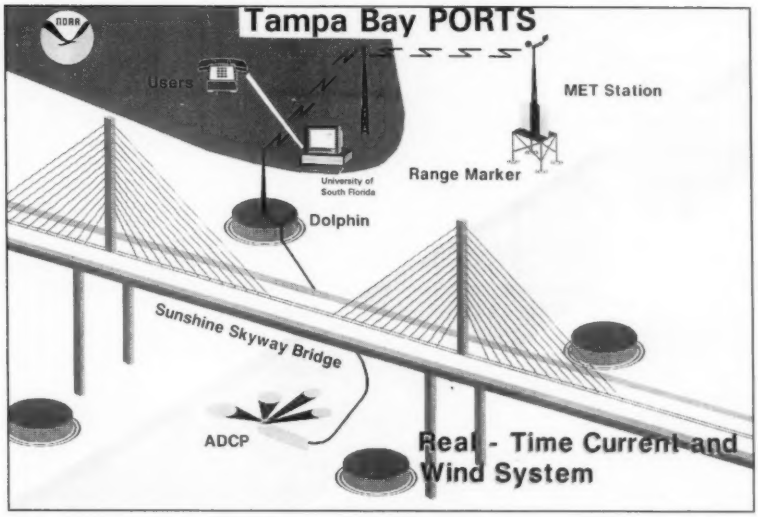
pilots were provided a PC software package called TIDES-ABC, with which they could obtain water level data from these locations via phone line to a PC with a modem (see sample printout from that program).

NOS is replacing old float tide gauges with Next Generation Water Level Measurement System (NGWLMS) field units that measure water level acoustically, can handle up to 11 ancillary sensors to measure parameters such as wind, pressure, and temperature and disseminate the data in real-time via GOES satellite or phone line. An updated version of TIDES-ABC, called REALDATA, can now provide the marine community with user-friendly real-time access to NGWLMS gauges.

Providing real-time current data has been more difficult and expensive (than providing water level data), because the current sensor has to be installed in the middle of the waterway (as opposed to a water level gauge installed on the end of a pier), but that situation has also improved as a result of recently developed technology. An acoustic doppler current profiler (ADCP) can sit on the bottom of a channel and provide current speeds and directions for the entire water column above it, with the ADCP cabled to the shore or to a buoy and the data radioed to the shore. Currents can change dramatically with depth, in and next to shipping channels, or around bends, so that a single current station may be unrepresentative of the total flow and miss dangerous shears. However, an ADCP on a ship or towed catamaran can provide cross-sectional views of currents in a channel as well as synoptic views of the currents over a region of the waterway (see left), which can be used in combination with the real-time current profiles obtained from the permanent bottom-mounted ADCPs.

The first permanent sites from which real-time current information was provided to the mariner were part of the Physical Oceanographic Real-Time System (PORTS) installed in Tampa Bay in 1990 and 1991 (see right). Whereas REALDATA provides single site access to an NWLON water level station, PORTS collects oceanographic and local meteorological data from numerous locations around a bay and then disseminates it in real-time to the marine community in a number of user-friendly forms. In addition to currents, PORTS presently provides water level, wind, barometric pressure, air temperature, and water temperature data and can add additional parameters.

PORTS real-time data dissemination presently take three forms. Information is updated every 6 minutes on computer screens at the U.S. Coast Guard offices in St. Petersburg and Tampa and several other offices in the area. This information can be accessed using a personal computer (PC) either by phone with a modem or via Internet. The data can also be obtained from any touchtone phone (without a PC) from a specially designed voice response system— just like calling a bank to check on an account. This last feature was added for the pilots who carry cellular phones on



Schematic of the current and wind sensors of the Physical Oceanographic Real-time System (PORTS) at Tampa Bay. The currents are measured near the bridge with a bottom mounted acoustic doppler current profiler (ADCP). The MET station measures wind speed and direction, barometric pressure and air temperature. Wind is also measured at four water level (tide) stations (not shown in the schematic).

board a ship. The PORTS is used every day by the pilots, but it is also called frequently by the entire marine community, especially during storms (for example during the height of Hurricane Andrew it was called 360 times in less than 1 hour). PORTS data was also used to help predict movement of an oil spill resulting from a three-vessel collision in August 1993, just inside the entrance to Tampa Bay.

The PORTS system in Tampa Bay is still the only system of its kind in the U.S. Recently a real-time current system has been installed in Hong Kong and a real-time water level system has been installed in the St. Lawrence Seaway. Other U.S. ports have requested similar systems and shortly, two small PORTS will be installed in the Port of New York and New Jersey and in San Francisco Bay. Both will be prototypes with specific technical objectives. In the Port of New York and New Jersey, the real-time data will be brought directly into the Coast Guard's new Vessel Traffic System (VTS) at Governor's Island, in addition to being provided to the pilots, the port authority, and the rest of the marine community via the same techniques used in Tampa Bay. Initially this information will be limited to currents, water levels, water temperature and salinity, along with meteorological parameters from Bergen Point and water levels from three other locations around the harbor. As part of this project a numerical hydrodynamic model will be installed and calibrated in order to provide predicted currents and water levels at other locations around the harbor, provide currents as input to oil spill drift models developed by NOS HAZMAT for use in OPA'90 oil response exercises and support development of a real-time electronic chart (to provide bathymetry or grounding lines). In San Francisco Bay, there is an added environmental purpose for the PORTS system. In addition to real-time currents (at Carquinez Strait) water levels, water temperature, and meteorological data, the system will include monitoring of salinity at several locations up-river from Carquinez Strait. This will help assess the effects on habitats of fresh-water withdrawal from the Sacramento and San Joaquin rivers.

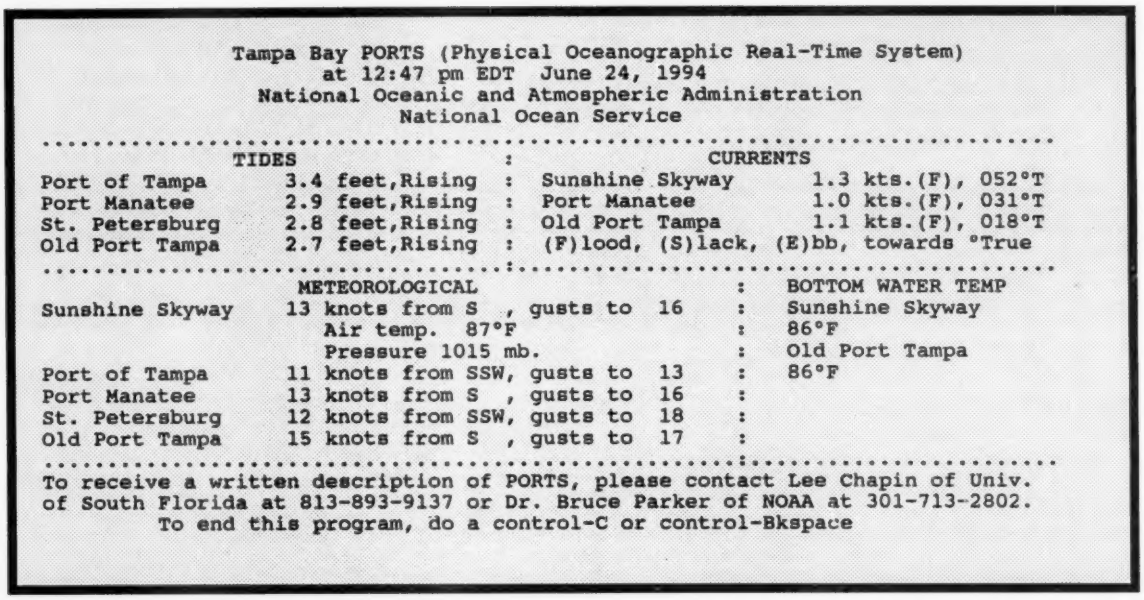
It is hoped that these systems can be expanded to provide critical real-time information for each entire waterway, and that similar PORTS can be installed in other U.S. ports where they are needed. It is also hoped that information on waves, visibility, and bridge clearance (air gap) can be added.

The Need for Forecasting– Going Beyond Real-time Data

Sometimes real-time data combined with tidal predictions are still not enough. It can take hours for a ship to transit a waterway, so a pilot must know what the water level will be in the near future. Likewise, if a ship is loading coal and needs to know how much can be loaded to take advantage of the water depths, the water level must be known even farther into the future.

The potential problems in determining accurate water levels in the near future are illustrated in the TIDES-ABC (REALDATA) output for Baltimore Harbor shown on page 13. Chesapeake Bay water levels are affected by the wind (both over the Bay and the continental shelf), which can change quickly when a weather system moves through. If a pilot called up the system at the time indicated by the vertical line in the chart, he would see that he had almost an extra foot of water level over the tide prediction, and based on the data from the day before, that extra foot looks like it should continue. The pilot would have no way of knowing that, in fact, the water level would decrease below the tide prediction over the next several hours.

Such situations are common, and an important future capability of all PORTS will be to provide accurate forecasts of water levels and currents. NOS



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              Tampa Bay PORTS (Physical Oceanographic Real-Time System)
                    at 12:47 pm EDT  June 24, 1994
                 National Oceanic and Atmospheric Administration
                          National Ocean Service
.....................................................................................
              TIDES                :                CURRENTS
Port of Tampa       3.4 feet,Rising  :  Sunshine Skyway      1.3 kts.(F), 052°T
Port Manatee        2.9 feet,Rising  :  Port Manatee         1.0 kts.(F), 031°T
St. Petersburg      2.8 feet,Rising  :  Old Port Tampa       1.1 kts.(F), 018°T
Old Port Tampa      2.7 feet,Rising  :  (F)lood, (S)lack, (E)bb, towards °True
.....................................:.....................................:.......
                    METEOROLOGICAL                          :   BOTTOM WATER TEMP
Sunshine Skyway     13 knots from S  , gusts to  16         :   Sunshine Skyway
                       Air temp.  87°F                      :   86°F
                       Pressure 1015 mb.                    :   Old Port Tampa
Port of Tampa       11 knots from SSW, gusts to  13         :   86°F
Port Manatee        13 knots from S  , gusts to  16         :
St. Petersburg      12 knots from SSW, gusts to  18         :
Old Port Tampa      15 knots from S  , gusts to  17         :
.....................................................................:.......
To receive a written description of PORTS, please contact Lee Chapin of Univ.
of South Florida at 813-893-9137 or Dr. Bruce Parker of NOAA at 301-713-2802.
        To end this program, do a control-C or control-Bkspace
```

Sample screen image of real-time oceanographic data from the Tampa Bay PORTS, obtained with a PC and modem or with a PC via Internet, and also as seen at the U.S. Coast Guard offices in St. Petersburg and Tampa.

is presently involved in several prototype projects to develop such a forecast capability. In cooperation with the National Weather Service (NWS) and Princeton University, NOS is developing a Coastal Forecast System (CFS), the first phase of which has been to implement a three-dimensional numerical hydrodynamic model of the entire U.S. East Coast out to the shelf break that is driven by the forecast winds from the NWS "eta" weather model. The coastal water levels forecast by the CFS model will be used to drive a bay or harbor model for each area where a PORTS is installed (or where a number of NGWLMS gauges are being accessed via REALDATA). Using these forecast water levels at the bay entrance, and forecasts winds, these models will predict water levels and currents throughout the bay or harbor. Chesapeake Bay is the site of the first such project where NOS, in cooperation with local universities, uses such a model to predict water levels based on real-time and forecast winds. For forecasts of water levels and currents in Tampa Bay, an accurate model of the Gulf of Mexico will be needed, but in the meantime statistical forecast methods using water level and wind data from along the Gulf Coast are being tested. The numerical model being implemented in New York harbor will also be driven at its ocean boundary by the East Coast CFS model to produce forecasts of water levels and currents in the harbor.

The ultimate goal is a national system that can provide real-time and forecast oceanographic and meteorological information to the mariner, in a convenient form, to help assure safe and efficient navigation in all U.S. harbors and waterways which in turn will help protect the environment from the hazardous material spills resulting from maritime accidents.

Accessing Real-Time Marine Data From Tampa Bay PORTS

From, touchtone phone: call (813) 822-5836 or (813) 822-0022 and follow directions (e.g. press 1 for currents, press 2 for water levels, press 3 for wind, press 4 for bottom water temperature).

From PC with modem: call (813) 822-5931; LOGIN as "ports" and SETUP is 2400,8,N,1. The screen is shown below and looks like that seen in the U.S. Coast Guard offices at St. Petersburg and Tampa.

VIA Internet: "telnet" to "ceob-hp825.nos.noaa.gov" and login as "screens."

Accessing Water Level Data From NGWLMS/NWLON Stations

Call (301) 713-2897 for information on obtaining REALDATA software.

Accessing real-time data from planned New York Harbor and San Francisco By PORTS Installations

Call (301) 713-2802 for information.

Turtle Diary

N. Charles Hanna Daboul
Third Mate, USNS ***Leroy Grumman***

Today for the first time in my 6 years at sea, I saw not just one but five small sea turtles during my 1200–1600 bridge watch, and I wanted to pass the details to you. After the recent issue of *National Geographic* dealing with the demise of sea turtles, I felt this information might be of use to someone.

On May 4, 1994 at 1030 UTC, 1230 (LST), the USNS ***Leroy Grumman*** was steaming on course 248T, speed 9 knots in the Mediterrean Sea. The sky was clear and sunny with some cirrus clouds. Winds were 075° at 10 knots and the sea water temperature was 16°C. It was one of those really pleasant days at sea.

I had just finished the noon slip and stepped onto the starboard bridge wing to have a look when I noticed a large object floating in the water about 30.4 meters (100 feet) off the starboard beam. I assumed it was plastic flotsam, but when I got closer I saw it was a sea turtle.

The time was 1224 LST, we were at position 37° 40.9'N, 002° 40.6'E. Swimming alone in the water was the first of five turtles. It was slowly moving its flippers and swimming away from the ship. The size of the shell was about .61 meters (2 feet) in length and was a greenish hue. Of the five, this was the most lethargic in movement and different in color.

At 1228 I sighted two turtles swimming together, about .61 meters (2 feet) apart. They were a little larger than the first turtle and had a golden to dark brown color. When the ship passed, I noticed they were much more active than the first one as they dove below the surface. Their front flippers moved pretty fast. As with all the turtles sighted on my watch, these were swimming at the surface.

At 1244 a lone turtle was sighted with the same brown hue to its shell and was actively swimming about at the surface. The shell size appeared to be just less than .61 meters (2 feet). The position of this sighting was 37° 36.9'N, 002° 35.9'E.

At 1555 I sighted two more turtles about 800 yards from each other at position 37 31.4°N, 002 09.6°E. They appeared to have the same golden to dark brown shell color as the others, but one of them was a full .76 meters (2.5 feet) in shell length.

Leroy Grumman remained on this course the entire watch. Unfortunately, plastic debris was sighted with grave frequency as I made a point to spend as much time on the wing as I could. The amount of floating trash was in fact depressing. In any event I hope these details will be of use to you. People have told me sea turtles are fairly rare in this part of the Mediterranean Sea.

GMDSS – A Safety Net for Mariners

CDR Mark Koehn and Lt. Bill Sites
National Weather Service

This is an updated version of the Spring 1993 Radio Tips column of the Mariners Weather Log. The information was coordinated with Steve Debrecht of the Defense Mapping Agency (DMA).

Uniphoto

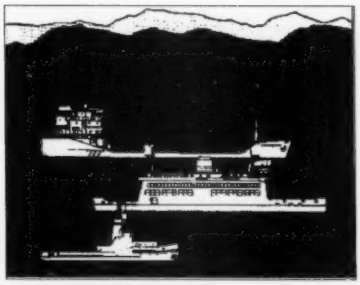
The Global Positioning System satellite navigation equipment provides reliable and accurate navigational fixes to ships anywhere on the world's oceans. Now mariners can plan on the same high quality Maritime Safety Information (MSI), which includes navigational warnings, meteorological warnings and forecasts and search and rescue information from both land-based coordinators and participating ships at sea. The Global Maritime Distress and Safety System (GMDSS) provides this service. GMDSS entered into force in February 1992 and will be fully operational by February 1999.

Under GMDSS, NOAA's National Weather Service, the U.S. Coast Guard and the Defense Mapping Agency broadcast alphanumeric Maritime Safety Information (MSI) to mariners via NAVTEX and SafetyNET. GMDSS was developed by the International Maritime Organization and coordinated with the International Hydrographic Organization and the World Meteorological Organization. GMDSS is defined in the International Convention for the Safety Of Life At Sea (SOLAS) 1974, as amended in 1988. These amendments will affect most vessels over 300 gross tons by the year 1999.

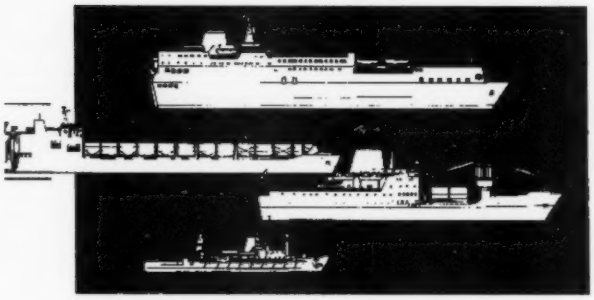
The GMDSS is made up of two components:

1) NAVTEX– a medium frequency (518 kHz) radio-based teleprinter system designed to supply MSI to mariners within about 200 miles of the shore; and
2) SafetyNET– an international automated direct-printing satellite-based service specifically designed to supply MSI to ships on the high seas.

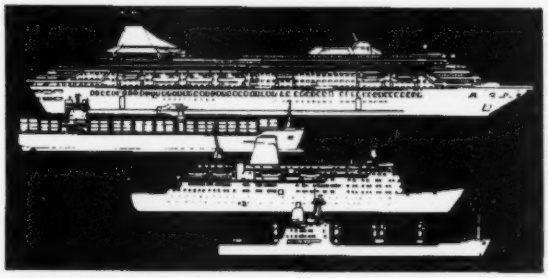
SafetyNET uses INMARSAT-C to deliver MSI



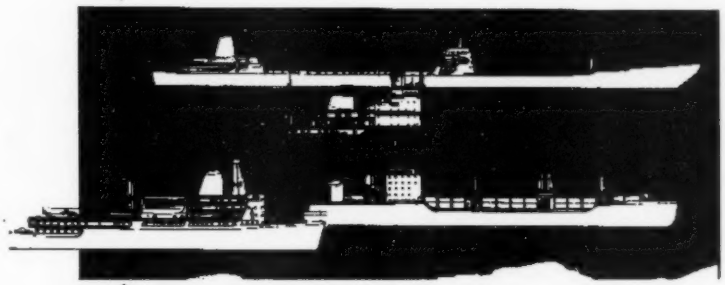
A1 *Within range of VHF coast stations (about 20 miles from shore).*



A2 *Beyond A1, but within range of MF coastal stations (about 100 miles from shore).*



A3 *Beyond A1 and A2, but within coverage of INMARSAT (Worldwide except for Polar regions)*



A4 *The remaining sea areas. (Polar regions).*

to mariners in all the world's oceans except poleward of about 75 degrees. SafetyNET is operated in the U.S. by COMSAT. Under GMDSS, the oceans are divided into four areas for the purpose of determining equipment carriage requirements as shown at right.

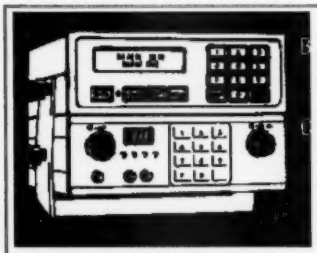
In accordance with the provisions of GMDSS, a vessel adhering to the SOLAS Convention must carry a suite of communications equipment depending on the ocean area in which it operates (A1, A2, A3, or A4). Basically, vessels will be required to carry NAVTEX equipment if they operate only within NAVTEX coverage and SafetyNET equipment if they operate outside of NAVTEX coverage. In addition, the following basic equipment must also be carried: VHF radio equipment with Digital Selective Call (DSC), a Satellite EPIRB, 9 GHz SAR Radar transponders, and portable VHF sets. IMO can provide detailed information on GMDSS equipment requirements. Note that not all nations offer a NAVTEX service– several nations, such as Australia, will rely on SafetyNET alone to deliver MSI to nearshore areas.

In the U.S., NAVTEX broadcasts originate from 12 U.S. Coast Guard (USCG) facilities. The National Weather Service (NWS) marine weather products broadcast over NAVTEX include coastal and/or offshore waters warnings and forecasts, depending on the particular area, while USCG products include Local Notice to Mariners. NAVTEX serves mariners within about 200 miles of Alaska, Hawaii, Guam, U.S. West Coast, U.S. East Coast, Gulf of Mexico, and Puerto Rico.

The SafetyNET satellite transmission system offers MSI with all-weather reliability and accessibility to all properly equipped vessels under the coverage area of the satellite– known as the satellite's footprint. To receive a SafetyNET transmission, a vessel must have a GMDSS type-approved INMARSAT-C transceiver aboard and initialized to receive information for the proper GMDSS Area(s). There are sixteen GMDSS MSI broadcast areas. (These areas are referred to as METAREAS by meteorological communities and NAVAREAS by hydrographic communities). The microprocessor within the shipboard INMARSAT-C transceiver determines in which METAREA the vessel is located (based on input of the vessel's position) and retains only those products addressed to vessels in that area. If, for example, your ship is located near 40°N, 160°W, and equipped with an approved and properly initialized INMARSAT-C terminal, and the ship's position has been entered into it and updated either manually or electronically by GPS, then you will receive MSI for Area 12 at the scheduled broadcast time. Note that some INMARSAT-C receivers are capable of receiving MSI from two MSI broadcast areas for voyage planning purposes. SafetyNET was designed to operate unattended around the clock and deliver a printed copy of the SafetyNET message to properly initialized INMARSAT-C receivers. GMDSS will operate

SafetyNET Broadcast Schedule for NWS Bulletins and Warnings

PRODUCT ID/	SATELLITE	METAREA	BROADCAST TIME (UTC)
NFDHSFAT1	(AOR–W)	04	0430, 1030, 1630, 2230
NFDHSFEPI	AOR–W, POR)	12	0545, 1145, 1745, 2345 (
MIAHSFEP3	(AOR–W)	16	0515, 1115, 1715, 2315



Above is a VHF DSC, on channel 70, and a printer with a VHF DSC watch receiver. (Courtesy of STC International Marine.)

Digital Selective Calling System

Digital Selective Calling (DSC) is an integral part of the GMDSS used primarily for transmitting distress alerts from ships and associated acknowledgements back from coast stations. It uses frequencies in the MF, HF or VHF bands. An important features is its ability to receive a call and be advised of its importance, without having to be near the radio. A station accepting a DSC call receives a display or printout of the address, the self–identification of the transmitting station, and the content of the DSC message along with an audible or visual alarm (or both) for distress or safety related calls. Currently if an unexpected storm develops or a gasoline barge becomes separated from its tow at night in a shipping channel, the fastest way for the Coast Guard to alert mariners is with an Urgent Marine Information Broadcast (UMIB). The Coast guard announces a pending UMIB over 2182 kHz and VHF channel 16, and then makes the broadcast over 2670 kHz and VHF channel 22A. DSC will take the place of this announcement on voice channel, by advising mariners to switch their radios directly to the appropriate broadcast channel. The Coast Guard is counting on DSC to make it easier to contact a vessel, particularly a nearby unidentified vessel, in an emergency. In order to increase the probability of a DSC distress call or relay being received, it is repeated several times. The transmission speed of a DSC call is 100 baud at MF and HF, and 1200 baud at VHF. Error correction coding is included, involving the transmission of each character twice, together with an overall message check character, which is used to ensure the technical integrity of the DSC system.

DSC distress calls are transmitted by a ship in distress and, being implicity addressed to "all ships," will be received by all suitably equipped ships and coast stations within propagation range of the frequency being used.

If anyone inadvertently sends a distress call over DSC or any other automated system, they must immediately notify the responsible rescue coordination center of the error. The worst possible scenario is to walk away from the radio and not answer the distress acknowledgement, leaving the rescue center to assume the worst has happened to the vessel. Not correcting the mistake is a prosecutable offense. For more information on DSC and GMDSS see the AMVER Bulltetin Number 1–94 available from AMVER Maritime Relations, Commandant (G–NRS–3/AMR), U.S. Coast Guard, Governors Island, NY, NY 10004–5034, USA.

in parallel with the present radio–based system of disseminating warnings and forecasts until February 1999. After that time, GMDSS will become the primary international means of distributing MSI to mariners.

In addition to serving as a platform for receipt of MSI, INMARSAT–C, is a commercial digital maritime service which offers Telex capabilities at a lower cost than is available on INMARSAT–A. The basic INMARSAT–C transceiver has no input or output devices attached, only a small antenna, but allows for several configurations such as the addition of a printer, terminal, or personal computer (PC). Many configurations include a PC for simplifying transmission and receipt of a ship's Telex message traffic. Also note that a ship's weather observations can be sent to the NWS, or other meteorological service, via INMARSAT–C using the "code 41" dialing procedure similar to INMARSAT–A. You can reduce communications costs to the NWS by more than 50% by sending observations via INMARSAT–C versus INMARSAT–A.

Questions or comments regarding the National Weather Service's participation in the Global Maritime Distress and Safety System can be addressed to Lt. Bill Sites at NWS, W/OM12, SSMC2, Room 14114, 1325 East–West Highway, Silver Spring, MD 20910, telephone (301–713–1677) or FAX (301–713–1598) or cc:mail, or internet (wsites@smtpgate.ssmc.noaa.gov).

GMDSS Questions

How does the NWS High Seas Bulletin or DMA Navigational Warning get to your ship?

Through COMSAT's two Coast Earth Station's (CES): one in Santa Paula, California for access to the Pacific satellite, and one in Southbury, Connecticut for access to the Atlantic West satellite. COMSAT provides the link from NWS, DMA, and USCG to ships at sea by way of the INMARSAT satellite system.

What NWS and DMA products are routinely broadcast over SafetyNET?

DMA delivers navigational warnings daily to NAVAREA 04 at 1000 and 2200 UTC and for NAVAREA 12 at 1030 and 2230 UTC, in addition to the regular broadcast over HF radio. The NWS High Seas Bulletins are issued for the Atlantic and Pacific and include storm and gale warnings, synopsis of major weather features, and forecasts.

The NWS will also continue to prepare and issue High Seas Bulletins every 6 hours for radio-based broadcasts until February 1999. Currently, the bulletins are disseminated by the USCG and selected commercial radio stations using HF radio in accordance with the schedules published in *Selected Worldwide Marine Weather Broadcasts.*

Are weather graphics available over INMARSAT?

Not yet. However, with the availability of satellite broadcast technology, it is apparent that the INMARSAT system, or other satellite-based systems, offers possibilities to support the transmission of weather graphics to mariners.

The following questions were raised at the PMO Conference:

Who has the responsibility to monitor NAVTEX broadcasts for conformance to broadcast schedules, product suite, and reception quality?

U.S. Coast Guard Communication Stations (COMMSTAS): Portsmouth, Boston, Miami, New Orleans, San Francisco, Honolulu, Marianas, and Kodiak, and the Greater Antilles Section (Gantsec in San Juan, Puerto Rico).

Are unscheduled products, such as updated storm warnings or short-fuse special marine warnings, broadcast over NAVTEX upon receipt by the USCG?

No, though the capability should exist to do so. The USCG can broadcast unscheduled navigational warnings on receipt, and does so, but in order to broadcast NWS weather products on receipt would require a flag in the broadcast product to key on, or a unique AFOS identifier to key on. This should be possible. The item will be placed on the agenda for the next USCG/NWS UNCLOG coordination meeting.

Is there a message priority scheme for NAVTEX?

Yes, but not like SafetyNET. NAVTEX has two different subject categories for weather: warnings (B) and forecasts (E). It also has three different broadcast scheduling categories: broadcast at next schedule; broadcast on receipt once channel is free; and call adjoining stations to clear channel for immediate broadcast.

What is the priority of NWS weather products?

NWS weather broadcasts use the forecast category; weather broadcasts via NAVTEX are only made on schedule.

Since NAVTEX is an automatic scheduled broadcast of maritime safety information (MSI), and ships receive the products automatically with a narrow band direct printing NAVTEX receiver, how will they know when a warning has been issued? Does the USCG announce it on Channel 16?

No, there should be no need to. NAVTEX messages are printed on receipt. NAVTEX receivers do have an alarm, but we believe only SAR messages can trigger it. However, the USCG does announce weather warnings on channel 16 prior to voice broadcast over channel 22A.

Are the Great Lakes covered by GMDSS? Will there be NAVTEX in the Lakes? Must the ships in the Lakes adhere to GMDSS regulations?

The Great Lakes are exempt from GMDSS. Canada intends to provide NAVTEX service on the Great Lakes. The U.S. does not intend to do so. Ships over 300 gross tons that also work beyond the Lakes must abide by the rules of GMDSS, in accordance with the geographic area in which she operates: A1, A2, A3, and A4.

NWS PRODUCTS ON NAVTEX

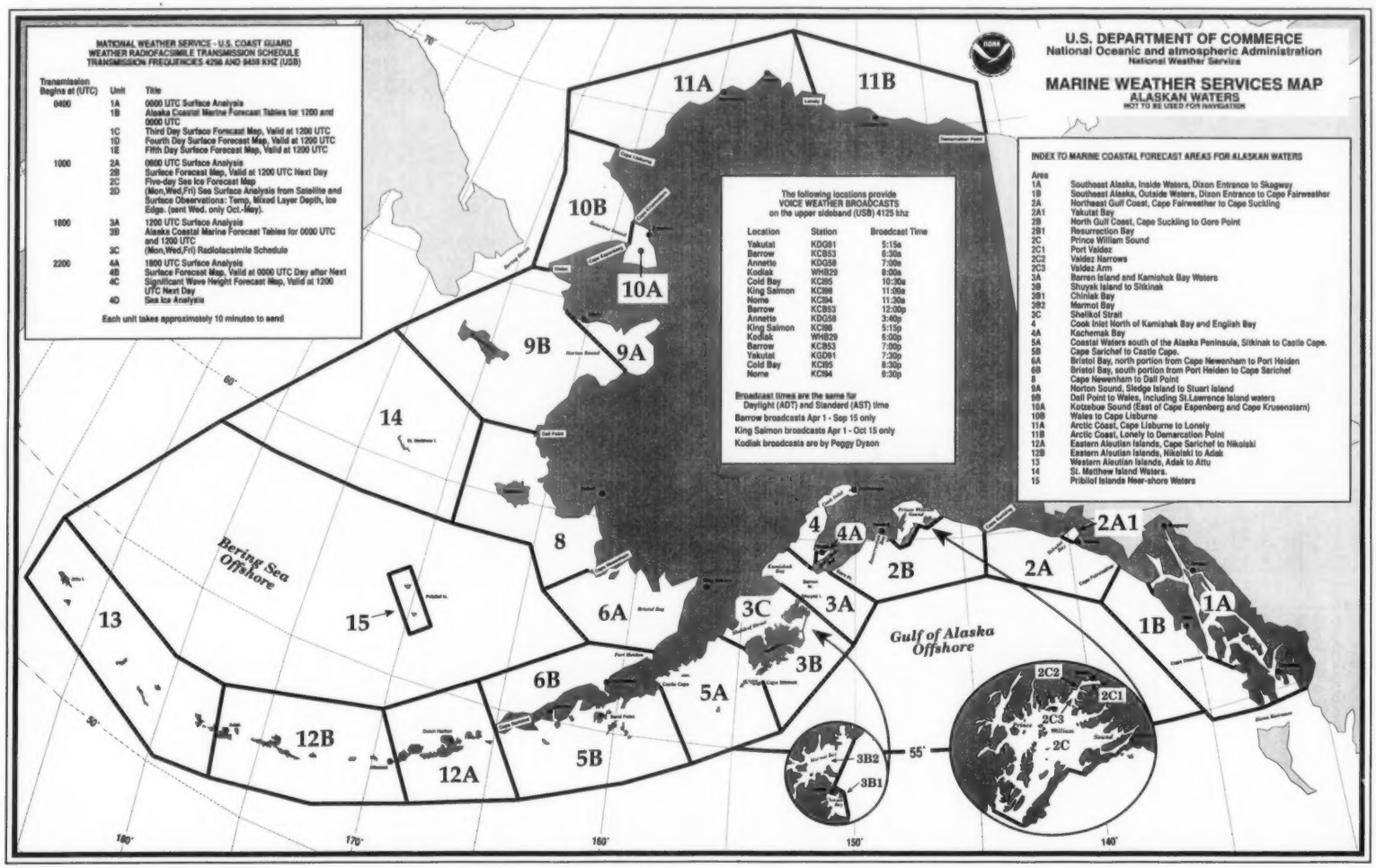
STATION IDENTIFIER	MARINE AREA
Adak, AK (X)	ANCCWF065 (AK marine areas 8,12a,12b,13) ANCCWFSNP (AK Pribilof Islands) ANCOFFANC (Gulf AK and Bering Sea) ANCCWF064 (AK marine areas 5a,5b,6a,6b) FAICWF066 (AK marine area 14)
Kodiak, AK (J)	ANCCWF063 (AK marine areas 3a,3b,3c,4,4a ANCCWF064 (AK marine areas 5a,5b,6a,6b) ANCOFFANC (Gulf AK and Bering Sea) ANCCWF062 (AK marine areas 2b,2c) JNUCWF061 (AK marine areas 1b,2a)

(see next page for a diagram of the Alaska Marine Areas)

Astoria, OR (W)	SEAOFFSEA (Offshore WA/OR, 60 to 250 mi) PDXCWFPDX (Coastal OR out 60 mi) SEACWFSEA (Coastal WA out 60 mi)
San Francisco (C)	SFOOFFSFO (Offshore CA, 60 to 250 mi) SFOCWFSFO (Coastal N. CA out 60 mi)
Cambria, CA (Q)	SFOOFFSFO (Offshore CA, 60 to 250 mi) LAXCWFLAX (Coastal S. CA out 60 mi) SFOCWFSFO (Coastal N. CA out 60 mi)
Marianas (V)	U.S. Navy Products
Honolulu (O)	HNLCWFHI (HI waters out 100 mi)
New Orleans (G)	NEWOFFNEW (Gulf of Mexico) NEWCWFNEW (Apalachicola to Port Arthur out 50 mi) SATCWFSAT (Port Arthur to Mexican Border out 50 mi)
Miami, FL (A)	MIAOFFMIA (SW N. Atlantic and Caribbean) MIACWFMIA (Savannah to Apalachicola out 50 mi)
Portsmouth, VA (N)	WBCOFFWBC (Offshore Mid–Atlantic)
Boston, MA (F)	BOSOFFBOS (Offshore New England)
San Juan, PR (R)	MIAOFFMIA (SW N. Atlantic and Caribbean) SJUCWFSJU (Puerto Rico and Virgin Islands out 20 mi)

NAVTEX BROADCAST SCHEDULE (UTC)

Adak	0340,	0740,	1140,	1540,	1940,	2340
Kodiak	0300,	0700,	1100,	1500,	1900,	2300
Astoria	0130,	0530,	0930,	1330,	1730,	2130
Cambria	0045,	0445,	0845,	1245,	1645,	2045
San Francisco	0000,	0400,	0800,	1200,	1600,	2000
Marianas	0100,	0500,	0900,	1300,	1700,	2100
Honolulu	0040,	0440,	0840,	1240,	1640,	2040
New Orleans	0300,	0700,	1100,	1500,	1900,	2300
Miami	0000,	0400,	0800,	1200,	1600,	2000
Portsmouth	0130,	0530,	0930,	1330,	1730,	2130
Boston	0045,	0445,	0845,	1245,	1645,	2045
San Juan	0200,	0600,	1000,	1400,	1800,	2200


NATIONAL WEATHER SERVICE - U.S. COAST GUARD
WEATHER RADIOFAC/SIMILE TRANSMISSION SCHEDULE
TRANSMISSION FREQUENCIES 4298 AND 8459 KHZ (USB)
Transmission Begins at (UTC) Unit Title
0400 1A 0000 UTC Surface Analysis
1B Alaska Coastal Marine Forecast Tables for 1200 and 0000 UTC
1C Third Day Surface Forecast Map, Valid at 1200 UTC
1D Fourth Day Surface Forecast Map, Valid at 1200 UTC
1E Fifth Day Surface Forecast Map, Valid at 1200 UTC
1000 2A 0600 UTC Surface Analysis
2B Surface Forecast Map, Valid at 1200 UTC Next Day
2C Five-day Sea Ice Forecast Map
2D (Mon,Wed,Fri) Sea Surface Analysis from Satellite and Surface Observations: Temp, Mixed Layer Depth, Ice Edge. (sent Wed. only Oct.-May).
1800 3A 1200 UTC Surface Analysis
3B Alaska Coastal Marine Forecast Tables for 0000 UTC and 1200 UTC
3C (Mon,Wed,Fri) Radiofacsimile Schedule
2200 4A 1800 UTC Surface Analysis
4B Surface Forecast Map, Valid at 0000 UTC Day after Next
4C Significant Wave Height Forecast Map, Valid at 1200 UTC Next Day
4D Sea Ice Analysis
Each unit takes approximately 10 minutes to send
U.S. DEPARTMENT OF COMMERCE
National Oceanic and atmospheric Administration
National Weather Service
MARINE WEATHER SERVICES MAP
ALASKAN WATERS
NOT TO BE USED FOR NAVIGATION
The following locations provide VOICE WEATHER BROADCASTS on the upper sideband (USB) 4125 khz
Location Station Broadcast Time
Yakutat KDQ81 5:15a
Barrow KCB53 6:30a
Annette KDG58 7:00a
Kodiak WHB29 8:00a
Cold Bay KCB85 10:30a
King Salmon KCB98 11:00a
Nome KCB94 11:30a
Barrow KCB53 12:00p
Annette KDG58 3:40p
King Salmon KCB98 5:15p
Kodiak WHB29 6:00p
Barrow KCB53 7:00p
Yakutat KQD91 7:30p
Cold Bay KCB85 8:30p
Nome KCB94 9:30p
Broadcast times are the same for Daylight (ADT) and Standard (AST) time
Barrow broadcasts Apr 1 - Sep 15 only
King Salmon broadcasts Apr 1 - Oct 15 only
Kodiak broadcasts are by Peggy Dyson
INDEX TO MARINE COASTAL FORECAST AREAS FOR ALASKAN WATERS
Area
1A Southeast Alaska, Inside Waters, Dixon Entrance to Skagway
1B Southeast Alaska, Outside Waters, Dixon Entrance to Cape Fairweather
2A Northeast Gulf Coast, Cape Fairweather to Cape Suckling
2A1 Yakutat Bay
2B North Gulf Coast, Cape Suckling to Gore Point
2B1 Resurrection Bay
2C Prince William Sound
2C1 Port Valdez
2C2 Valdez Narrows
2C3 Valdez Arm
3A Barren Island and Kamishak Bay Waters
3B Shuyak Island to Sitkinak
3B1 Chiniak Bay
3B2 Marmot Bay
3C Shelikof Strait
4 Cook Inlet North of Kamishak Bay and English Bay
4A Kachemak Bay
5A Coastal Waters south of the Alaska Peninsula, Sitkinak to Castle Cape.
5B Cape Sarichef to Castle Cape.
6A Bristol Bay, north portion from Cape Newenham to Port Heiden
6B Bristol Bay, south portion from Port Heiden to Cape Sarichef
8 Cape Newenham to Dall Point
9A Norton Sound, Sledge Island to Stuart Island
9B Dall Point to Wales, including St.Lawrence Island waters
10A Kotzebue Sound (East of Cape Espenberg and Cape Krusenstern)
10B Wales to Cape Lisburne
11A Arctic Coast, Cape Lisburne to Lonely
11B Arctic Coast, Lonely to Demarcation Point
12A Eastern Aleutian Islands, Cape Sarichef to Nikolski
12B Eastern Aleutian Islands, Nikolski to Adak
13 Western Aleutian Islands, Adak to Attu
14 St. Matthew Island Waters.
15 Pribilof Islands Near-shore Waters
11A
11B
10B
10A
9B
9A
14
8
4
4A
2A1
2B
2A
1A
1B
3C
3A
3B
6A
6B
5A
5B
13
15
12B
12A
Bering Sea Offshore
Gulf of Alaska Offshore
3B2
3B1
2C2
2C1
2C3
2C
70°
60°
50°
55°
180°
170°
160°
150°
140°

INMARSAT AND BEYOND

Gary Soneira
National Ocean Service

For hundreds of years, mariners have extended an imaginary line southwestward through the pointers of Ursa Major to the first-magnitude star Regulus, the brightest star in the constellation Leo. In the not too distant future, mariners may find other LEO constellations to rely upon. These constellations will not be blazing points of light in the distant heavens but communications satellites a few hundred miles above the earth in Low Earth Orbit (LEO). The other common orbital configurations for satellite constellations are geostationary earth orbit – satellites which appear to be in a fixed position above earth – and mid-altitude earth orbit, about 5,700 nautical miles above the earth.

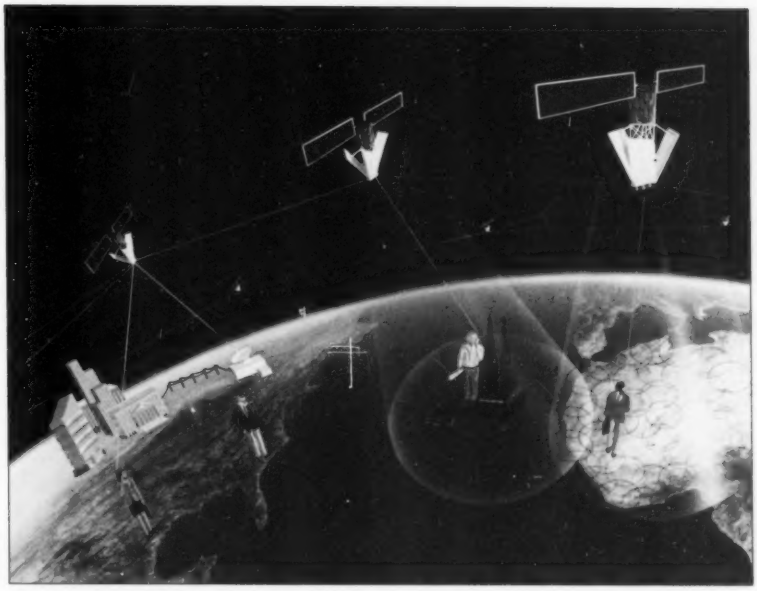
Just as navigation has evolved from the relatively crude positioning capability of the sextant and chronometer to the precision and availability of the Global Positioning System (GPS), so too has communication evolved. A host of manufacturers, with names ranging from the familiar to the exotic, are in headlong competition to provide mobile communication capability to remote locations anywhere on earth. These manufacturers are targeting diverse applications in their attempt to carve a niche in the communications market. Their objective is to put small handheld terminals, similar to the ubiquitous cellular phone, into the hands of people who live and work in remote locations.

For mariners, worldwide satellite communication has been a way of life since 1982 when Inmarsat began Service A to the marine and aviation communities. Inmarsat, comprised of 71 member countries, offers direct-dial telephone, telex, facsimile, electronic mail, data transmission, and safety and emergency services. Because Inmarsat service is based on a constellation of geostationary satellites, which are more than 19,000 nauti-

This article is a summary of the new technology that will be involved in the transmission and reception of weather data in the near future. The mention of private companies is in no way an endorsement of any company but is necessary to show the future of government and private industry working together to improve marine weather prediction and communications in general. We are indebted to companies like Orbital Communications Corp., Iridium (Motorola), Globalstar and others for providing the information and graphics necessary for this article.

cal miles above the earth, the associated equipment has special power and transmission requirements. High data rates and the high power required for voice transmission to geostationary satellites plus the need for geostabilized directional antennas for aiming at the satellite result in relatively large and expensive equipment.

If the system of geostationary satellites works, why fix it by switching to a LEO configuration? The use of dense (26, 48, 66) satellite constellations, relatively close to earth, will offer features difficult or impossible to obtain by geostationary orbit. The closeness of the satellites reduces the signal delay that occurs with medium-orbit and geostationary satellites. Because less power is needed to communicate to a LEO, the need for large transmitters is eliminated, and the cost of the user terminal is lower. Some estimates suggest that the RF power level will be reduced by 100 times! Lower cost is also achieved by the use of omnidirectional antennas. The large number of satellites in a constellation could accommodate multiple satellite failures with minimal impact on service because the user will typically always be in range of two or more satellites. Manufacturers can take advantage of a mass-production approach to satellites, user-terminals, and ground stations, and pass savings along to the user.



An example of global personal communications using the Low Earth Orbiting (LEO) satellite configuration is shown at left. This system, planned by Iridium, calls for eleven satellites in each of the six planes located 420 miles above the earth. Above is Iridium's concept of how its telephone will connect users to their local cellular telephone system or to satellites overhead. Those satellites in turn will relay wireless voice, paging, data or facsimile signals around the world to ground stations, which will switch calls to land line facilities and interconnect with telephones, computers and fax machines, anywhere in the world. Artwork courtesy of Iridium.

The systems currently under development will be interoperable with existing public switched telephone and cellular networks. This structure serves as an extension and enhancement to existing networks, and in some cases provides the only available service. Whereby Inmarsat services about 30,000 users, the projected market for mobile satellite communication is 100 million users by the year 1999. Global service coverage makes it possible to amortize the cost of the system over a world-wide market.

Although cost is a significant motivator, it's the application of the service which holds the greatest appeal to the marine industry. Doppler shift position determination is an inherent feature of the satellites in these orbits. Although this position information is not to GPS accuracies, it can be invaluable for search and rescue operations. In an emergency situation, there may be nothing more comforting than the sound of another human voice. User terminals will be small enough to carry into life rafts, or even made part of the raft standard equipment, allowing rescue personnel to be in direct voice contact with survivors. Under certain conditions, terminals can be air-dropped onto the deck of a vessel in distress. Under less extreme conditions, worldwide communication will improve fleet management capability. Fleet owners and operators can be in contact with their total corporate assets from the boardroom, car, airplane, or ship's bridge. Ships can be rerouted to avoid severe weather or pick up supplies or cargo. Mariners could call up oceanographic buoys and platforms along their route to take advantage of knowledge of distant conditions, should the scientific community chose to embrace the LEO concept. It is logical to conclude that if scientific organizations improve the timeliness, quality, quantity, and coverage of data collection then the quality of marine forecasts will also improve.

Correspondence with several system manufacturers suggests that most will fall into one of three possible

	Type	Analog/ Digital	Size of Antenna dia. & ht.	Size of Terminal	Weight of Terminal/ Antenna	Cost per Minute
Inmarsat A	voice/telex fax	analog	0.9–1.2 m (3–4 ft)	various size of computer/ phone/fax	120 kg (264 lbs)	$6-$8 voice $4 telex
Inmarsat B	voice/telex fax	digital	0.9 m (3 ft)	various size of computer/ phone/fax	100 kg (220 lbs)	$5–$6 voice $3–$4 telex
Inmarsat C	telex/data	digital	0.3 m (1 ft)	various size of computer/ phone/fax	10 kg (22 lbs)	$1–$1.50 telex
Inmarsat M	voice/fax/digital		0.5 m (1.7 ft)	various size of computer/ phone/fax	25 kg (55 lbs)	$3–$6
Inmarsat P	voice/data	digital	n/a	handheld	750 grams (2 lbs)	not yet determined
Iridium planned	voice/data fax, paging	digital	n/a	handheld	handheld	$3 + $50/ mo.
ORBCOMM planned	data/fax	digital	n/a	handheld	handheld	$.50 1st 250 char. $.004 per char. thereafter
Globalstar planned geolocation	voice/data fax, paging	digital	n/a	handheld	handheld	$ .30

The table above lists the specifications of most current and planned satellite communications services available to the mariner. Since three of the systems are not yet in operation, exact figures are not available. Until recently, satellite equipment has been bulky and expensive. But planned services like Iridium, Orbcomm and Inmarsat P will remove the bulk drawback by introducing handheld tranceivers. This table was excerpted from an excellent article entitled "The Satellite Mix" by Chuck Husick. The article appeared in the March/April 1994 issue of the Ocean Navigator *P.O. Box 569 Portland, ME 04112.*

configurations. All offer line of site communications to users within the same satellite footprint and position determination. Enhanced positioning, when needed can be achieved through the Global Positioning System (GPS). The basic elements of these systems are (1) User Terminal (UT), similar to a cordless telephone, (2) space segment, an array of small communications satellites positioned in various orbital planes, and (3) earth station facilities which relay messages to and from satellites, to public switched telephone networks, or where available, terrestrial cellular networks.

A typical message relay path is from the UT to the satellite (right) where it is stored until the satellite approaches a Gateway Earth Station (GES). The regional GES functions as the downlink/ uplink site. The GES passes the message to either another satellite or via leased landline to the Network Control Center (NCC). The NCC determines the path to the recipients' location and routes the message to the appropriate GES. The GES transmits the message up to the satellite corresponding to the recipient's location. The relay is completed when the satellite transmits the message to the addressee. This seemingly complex route from initial call to receipt actually takes about 3 seconds.

One configuration uses a network of 26 satellites and is designed for two-way personal messaging and data communication. This group has a network of gateway earth stations, network control centers, space segment, and users. The ORBCOMM system proposed by Orbital Communications Corporation falls into the category. The ORBCOMM system may have interest to mariners since it will provide an alternative to Inmarsat Service C. ORBCOMM is estimating the user terminal price from $100 to $400 depending on the application, features, and degree of sophistication. The system scheduled to become operational in 1995 will allow transmission and reception of digital data.

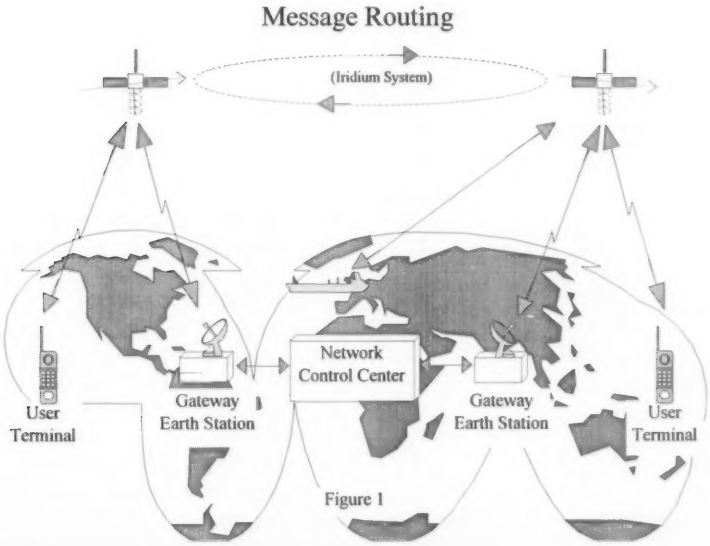
With a data rate of only 2400 bps uplink and 4800 bps downlink, the user terminal will not be capable of voice transmissions. Positioning accuracy is expected to be approximately 0.5 nautical mile. Hull Electronics of El Cajon, Ca., has announced the development of an ORBCOMM terminal for marine use. A user will enter and receive text messages from a computer (laptop, palmtop, or desktop) with an interface to the unit which will transmit to the next available satellite.

A second concept, as proposed by Loral Qualcomm's Globalstar System, consists of 48 satellites in circular orbits at an altitude of 759 nautical miles. The basic elements (space segment, earth stations, user terminal) are the same but the Globalstar system will offer data and voice communications through its network. Globalstar will route calls through existing public and private telephone companies. Due to the continual orbit of the satellites, the Globalstar system will use their patented soft hand-off technique which automatically selects and combines the best signal paths from two or more satellites. The higher density constellation will result in greater satellite acquisition potential. Globalstar is anticipating launches to begin late 1997 with operational services available early in 1998. Globalstar terminals are expected to cost about $700 per unit.

The final category as proposed by Motorola's Iridium is the most ambitious. It uses a very high density (66 platform) constellation in LEO with the communications relay handled in the space segment as well as through a network of ground stations. This means some calls between two Iridium subscribers, even if on opposite sides of the planet, will be connected solely through the satellite network. With 66 satellites in 6 orbital planes every square inch of earth is covered. The Iridium handsets have an automatic position reporting feature which is activated when the unit is turned on, allowing the Iridium satellites to find the user and route calls through the network. The handset will search for and use compatible terrestrial cellular networks whenever available so that user charges are at the local cellular rate. Because users can be located anywhere, cellular and telephone operators, including Inmarsat signatories, can include Iridium services as part of their service offerings. At the comparatively high cost of about $3,000 per user terminal, Iridium is clearly the "Cadillac" system utilizing expensive features to improve voice quality and minimize static, delays, and annoying echoes.

Regardless of which system becomes the choice of mariners, the next 5 years is going to bring a major change in the way mariners receive information, transmit data and stay in touch with the rest of the world.

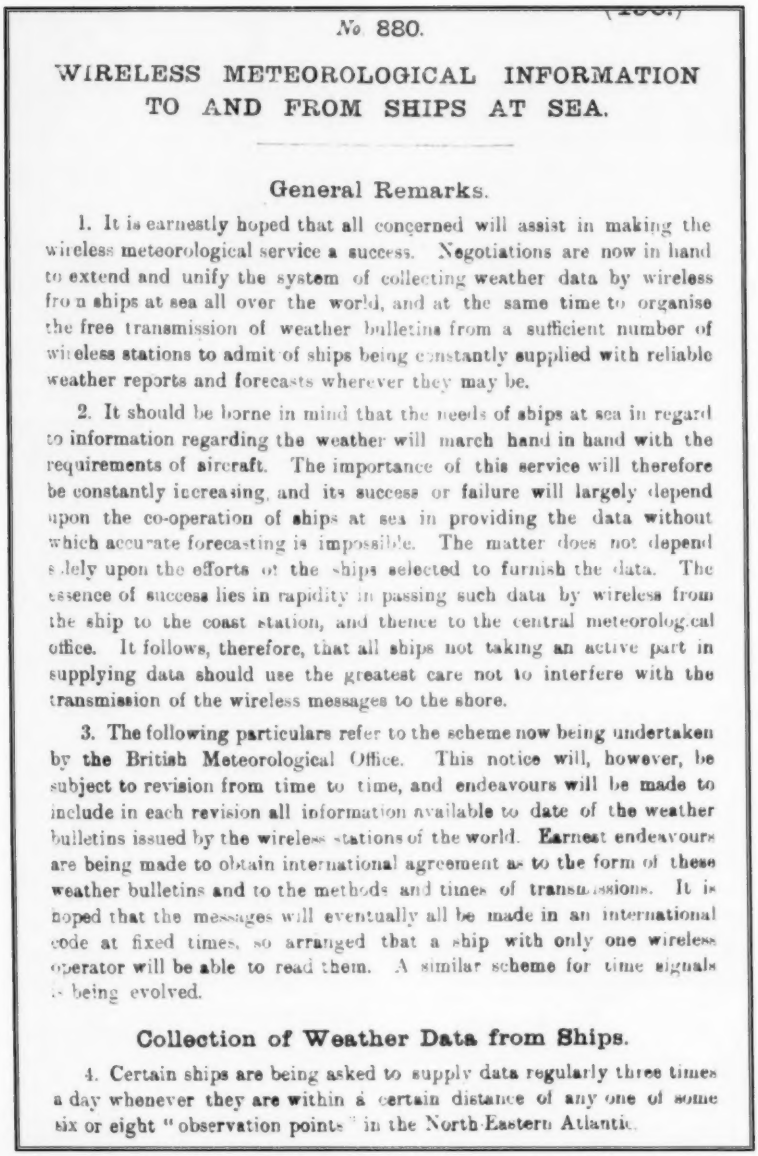
An example of the handheld units is the Iridium Dual-Mode Portable Telephone which is designed to work with existing cellular systems by searching first for a local terrestrial channel before opening one of its own circuits. Courtesy of Iridium.



Basic message routing using the Low Earth Orbit satellite system.

The Admiralty List of Radio Signals

Alec T. Reynolds
Hydrology Office
Taunton, Somerset, England



No. 880.

WIRELESS METEOROLOGICAL INFORMATION TO AND FROM SHIPS AT SEA.

General Remarks.

1. It is earnestly hoped that all concerned will assist in making the wireless meteorological service a success. Negotiations are now in hand to extend and unify the system of collecting weather data by wireless from ships at sea all over the world, and at the same time to organise the free transmission of weather bulletins from a sufficient number of wireless stations to admit of ships being constantly supplied with reliable weather reports and forecasts wherever they may be.

2. It should be borne in mind that the needs of ships at sea in regard to information regarding the weather will march hand in hand with the requirements of aircraft. The importance of this service will therefore be constantly increasing, and its success or failure will largely depend upon the co-operation of ships at sea in providing the data without which accurate forecasting is impossible. The matter does not depend solely upon the efforts of the ships selected to furnish the data. The essence of success lies in rapidity in passing such data by wireless from the ship to the coast station, and thence to the central meteorological office. It follows, therefore, that all ships not taking an active part in supplying data should use the greatest care not to interfere with the transmission of the wireless messages to the shore.

3. The following particulars refer to the scheme now being undertaken by the British Meteorological Office. This notice will, however, be subject to revision from time to time, and endeavours will be made to include in each revision all information available to date of the weather bulletins issued by the wireless stations of the world. Earnest endeavours are being made to obtain international agreement as to the form of these weather bulletins and to the methods and times of transmissions. It is hoped that the messages will eventually all be made in an international code at fixed times, so arranged that a ship with only one wireless operator will be able to read them. A similar scheme for time signals is being evolved.

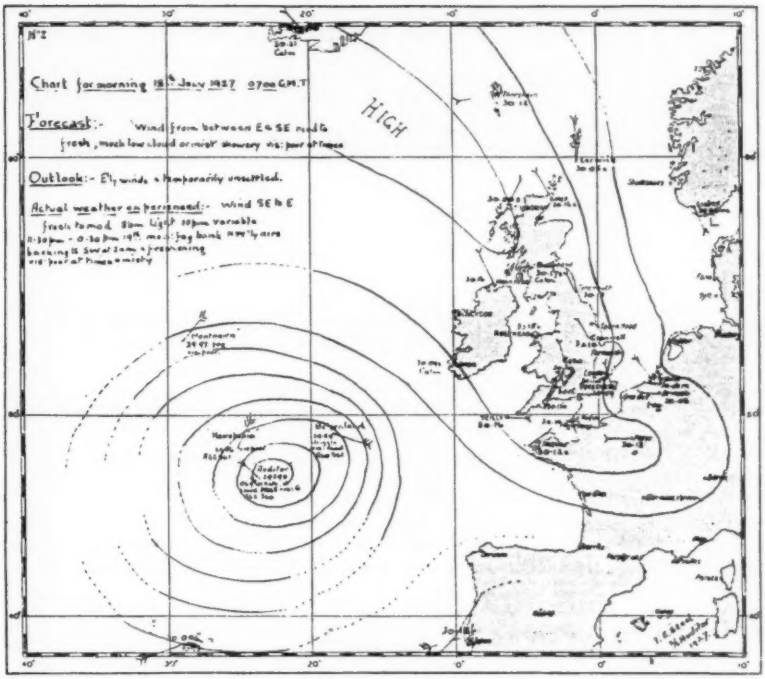
Collection of Weather Data from Ships.

4. Certain ships are being asked to supply data regularly three times a day whenever they are within a certain distance of any one of some six or eight "observation points" in the North-Eastern Atlantic.

Prior to the publication of the Admiralty List of Wireless Signals in 1922, wireless information was issued through daily Notice to Mariners. The first of these above was turned out in 1919.

Almost every Radio Officer at one time or another has come across the Admiralty List of Radio Signals, popularly referred to as ALRS. ALRS forms part of the package of Nautical Publications published by the United Kingdom Hydrographic Office to complement the well-known Admiralty Charts. The six volumes of the current ALRS series are split on a functional basis and each provides worldwide details of particular maritime radiocommunication systems. The origin of the series dates back to 1922 when the first volume of what was then called *The Admiralty List Wireless Signals* was published. Prior to this date, wireless information was issued to the mariner through the daily Notices to Mariners system, the first such notice being number 691 of 1919 (left).

ALRS currently contains all the working details of the many and varied types of maritime radio communications, but the contents of the original publication was based around the then universal use of the WT (Wireless Telegraphy). There was great emphasis on the WT services provided by many "Direction Finding Stations throughout the World," and indeed these services accounted for the largest individual section within the publication. Other WT services included information on Fog Signal Stations, Weather Bulletins and Storm Signal Stations, Press Messages and Medical Advice, Navigational Warnings and Time Signals.



A weather chart of the eastern North Atlantic made on board the S.S. **Auditor** *(Captain W.T. Owen) on a voyage from Tampico to Rotterdam, by Mr. T. E. Steel, Third Officer on July 18, 1927. Courtesy of the* Marine Observer.

Below is the official notice of the first of the List of Wireless Signals in 1922.

Many of these services, using the latest range of frequencies and modes of emission, have their direct counterparts in today's maritime communications. Within Notice to Mariners number 880 of 1919 was the sentiment "...[it is] earnestly hoped that all concerned will assist in making the wireless meteorological services a success...." From these optimistic beginnings, maritime radio communication services have grown beyond the wildest dreams of those early sparks. During the 1920's and 30's, radio broadcasting rapidly developed and with it the services specifically designed for the mariner. ALRS grew along with these developing services and had expanded to three volumes by the outbreak of World War II.

The contents of ALRS have always been diverse and have evolved in response to changing or new requirements. For instance, the use of WT has been supplemented by increasingly sophisticated alternatives to the point where it has been superseded and is now rapidly falling into disuse as a means of commercial radiocommunications. Further technical developments and the requirements of systems such as GMDSS and VTS will undoubtedly force major reappraisals of the needs of maritime radio communications in the future. Since its inception, ALRS has been kept fully up-to-date through corrections issued in the *Weekly Notices to Mariners* and updating new editions. Currently, with the exception of Volumes 4 and 5, the series is revised annually in editions spread over the year. Each new edition incorporates all the corrections issued through the *Notice to Mariners* system, together with amounts of information received during the currency of the previous edition that was not issued in order to keep the number of hand corrections at a manageable level. Volume 4 (List of Meteorological Observation Stations) is not updated by weekly corrections and only receives a new edition every 3 years. However, it is unique in that it is the only publication in the series that is presently available in digital format. The most recent addition to the series, Volume 5 (GMDSS), is updated by weekly correction but only requires revision by new edition about every 18 months to 2 years.

During 1993, over 2,000 stations listed in ALRS were updated by amendments contained in the Weekly Notices to Mariners. A substantial amount of the information that results in the preparation of a correction comes directly from ships at sea. Until comparatively recently, this was almost exclusively the work of the Radio Officer, but nowadays the reports are more likely to come from any of the Bridge Officers. Nevertheless, these Officers are helping to fulfill the sentiments expressed in NM 880 of 1919 and without their help we would not be able to maintain ALRS as an up-to-date source of information for all matters relating to modern radiocommunication.

ADMIRALTY
NOTICE TO MARINERS.

No. **1891** *of the year* 1921.

ADMIRALTY PUBLICATIONS.

List of Wireless Signals, 1922.

On 31st January 1922 a new publication, entitled "Admiralty List of Wireless Signals containing details of Direction Finding Stations, Weather Bulletins, Storm and Navigational Warnings and Time Signals"

ADMIRALTY
LIST OF RADIO SIGNALS

The Admiralty List of Radio Signals (ALRS) is produced in England by the Hydrographer of the Navy, the publisher of Admiralty Charts and associated Hydrographic Publications. It consists of six volumes of text and complementary diagrams; the principal contents of these volumes is listed below.

New editions of all volumes, except volumes 4 and 5, are issued annually; volume 4 has a new edition every three years as its contents are subject to fewer significant changes; volume 5 will have a new edition as demand dictates.

The books are corrected, as necessary, each week, by Section VI of the Admiralty Notices to Mariners.

ALRS is very widely used on board vessels of all nations, both on the bridge and in the radio room, because it provides world-wide cover and corrections are made available weekly in a convenient form.

Individual copies of ALRS books, or complete sets may be purchased from Admiralty Chart Agents.

Users are requested to send details of new and amended items of information for ALRS to: Thematic Charts and Publications (B), Admiralty List of Radio Signals, Hydrographic Office, Taunton, Somerset TA1 2DN, England, Telephone (0823) 337900, Fax (0823) 284077 Telex 46274. Information can be forwarded on the ALRS Report Sheet to be found at the front of each volume, or at the front of Section VI, Admiralty Notices to Mariners.

VOLUME 1 (NP 281 (1&2))

Coast Radio Stations (Public Correspondence); Medical Advice by Radio, arrangements for Quarantine Reports, Locust Reports and Pollution Reports; INMARSAT, Maritime Satellite Service; Global Maritime Distress and Safety System; Distress, Search and Rescue procedure, Ship Reporting Systems; Regulations for the use of Radio in Territorial Waters, and a brief extract from the International Radio Regulations; associated diagrams.

Part 1 covers Europe, Africa and Asia (excluding the Philippine Islands and Indonesia). Part 2 covers the Philippine Islands, Indonesia, Australasia, the Americas, Greenland and Iceland.

VOLUME 2 (NP 282)

Radio Navigational Aids (including Aero Radiobeacons in coastal regions, Radio Direction-finding Stations, Coast Radio Stations which give a QTG service, Calibration Stations (i.e. stations giving special transmissions for the calibration of ships' DF), and Radar Beacons (Racons and Remarks). Radio Time Signals, Legal Time and Electronic Position Fixing Systems (including Satellite Navigation Systems); associated diagrams.

VOLUME 3 (NP 283)

Radio Weather Services and Navigational Warnings together with related information, including certain Meteorological Codes provided for the use of shipping; associated diagrams

VOLUME 4 (NP 284)

List of Meteorological Observation Stations; associated diagram. A PC Version (ASCII) of this Volume can be obtained by using the special order form to be found in the front of this publication.

VOLUME 5 (NP 285)

Global Maritime Distress and Safety System (GMDSS), information and associated diagrams, including extracts from the relevant International Radio Regulations and Services available to assist vessels using or participating in the GMDSS.

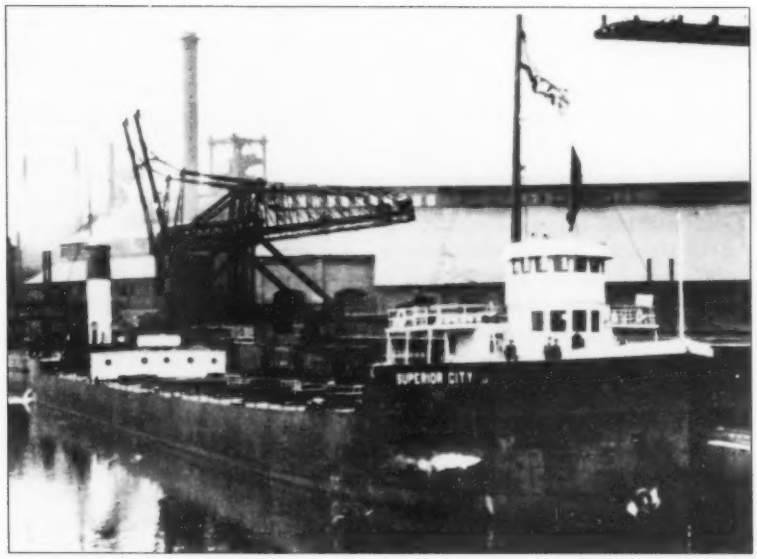
VOLUME 6 (NP 286 (1 & 2))

Stations working in the Port Operations, Vessel Traffic Management and Information Services, services to assist vessels requiring Pilots, and services for Small Craft (information on Marina and Harbor VHF facilities); associated diagrams. Part 1 covers NW Europe and the Mediterranean. Part 2 covers Africa and Asia (excluding Mediterranean Coasts), Australasia, the Americas, Greenland and Iceland.

HYDROGRAPHIC OFFICE, Taunton, Somerset TA1 2DN
Tel: (0823) 337900 FAX: (0823) 284077 Telex: 46274

Superior City

Skip Gillham



Milwaukee Library Collection

Spring storms, fall gales and blankets of thick fog have caused many of the marine casualties on the Great Lakes. But the loss of the ***Superior City***, 74 years ago this summer, occurred not because of a meteorological event but from human error.

Superior City, a 137-meter (450 foot) long bulk carrier was built at Lorain, Ohio, in 1898 and launched on April 13. Exactly 2 months later, on June 13, the vessel made history loading the first 7,000-ton cargo, a shipment of grain taken aboard at Chicago. Originally part of the Zenith Transportation Co., it joined the Pittsburgh Steamship Division of U.S. Steel 1901 and remained in their colors to the end.

The vessel's last cargo, 7,600 tons of iron ore, rattled aboard at Two Harbors, Minnesota, in mid August 1920, and the 4,795-gross ton freighter headed out into Lake Superior.

On August 20, in Whitefish Bay at the eastern end of the lake, the ship met with the steamer ***Willis L. King***, upbound and in ballast from Ashtabula, Ohio. According to most reports, visibility was excellent and the two ships had observed each other for some time. Unfortunately, confusion over passing signals resulted in a grinding collision at 2110 hours and the bow of the ***Willis L. King*** struck the ***Superior City*** on the port side just aft of midship.

Water poured through the gaping hole and the ***Superior City*** quickly sank 81 meters (265 feet) below the surface of Lake Superior with the loss of 29 lives. The boilers exploded on contact with the cold lake water and only four sailors survived the disaster.

The ***Willis L. King*** returned to Sault Ste Marie with only bow damage. The latter, renamed the ***C.L. Austen*** in 1853, survived until scrapping at Ashtabula in 1984-85.

An investigation of the collision failed to pinpoint liability, and both ships were found to be at fault.

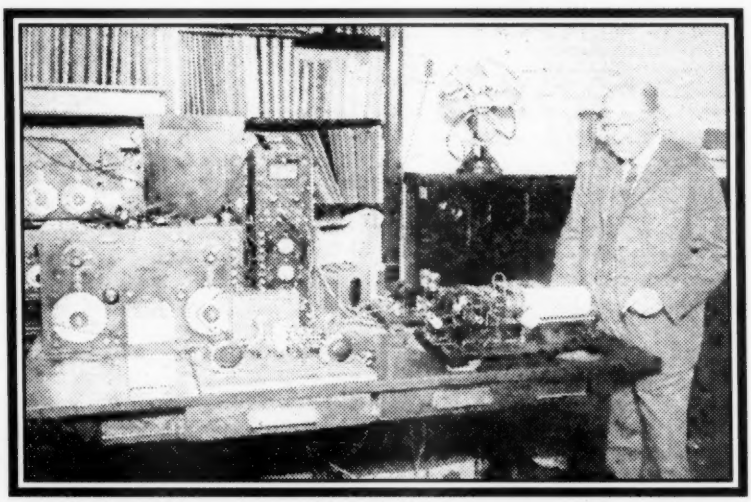
THE BROADCASTING OF WEATHER MAPS BY RADIO ACCOMPLISHED

B. Francis Dashiell
Radio News
January 1927

If you should hear some apparently meaningless jumble of dots and dashes over your radio that bear no resemblance to the radio code, do not worry because they can not be decoded. They indicate that a weather map is being broadcast by radio.

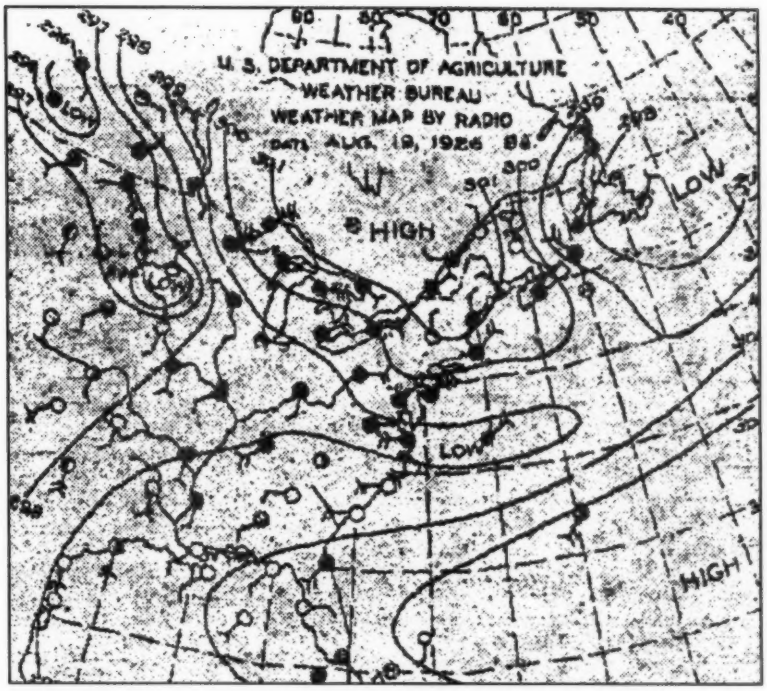
The Navy Department is cooperating and has permitted the Weather Bureau and the Jenkins Laboratory to install their transmitter in the powerful naval station NAA at Arlington, Virginia. The transmission set loaned by the Navy and used for the transmission of the weather maps operates on 8,330 meters and is rated at 40 kilowatts. The Navy is providing not only the transmission facilities but two warships for special receptions. These ships are the U.S.S. ***Kittery*** and ***Trenton***.

Tests which have been conducted between the Weather Bureau and NAA are showing pleasing results. An experimental laboratory and receiving equipment have been installed in the Weather Bureau under the direction of C. Francis Jenkins, the inventor, Dr. Charles F. Marvin, Chief of the Weather Bureau and E.B. Calvert, Chief of Forecasters, and a well known advocate of radio in the work of the Weather Bureau. Dr. Marvin, as well as other officials of the Weather Bureau, who are engaged in these experiments, see in the transmission of weather maps by radio a beginning of a new and important era in meteorological navigation at sea. The Navy Department, realizing the great value to its ships in being able to obtain correct pictures of weather maps immediately after their preparation by the Weather Bureau is giving it close cooperation, through Commander Hooper, Chief of Naval Communications, and is watching the outcome of this pioneer adventure into visual radio broadcasting.



A complete weather map adapted to radio transmission and embracing the areas with which navigation is always concerned is prepared daily by the Weather Bureau. The map is then printed on an 8-by10-inch sheet of photographic film and this negative is used for the actual transmission. The map received is of the same size.

The Jenkins system by which pictures are transmitted by radio is highly interesting. The photographic negative of the weather map is placed about a glass cylinder which revolves at a steady rate while advancing one-fiftieth of an inch with each revolution. A very small beam of light, passing through the cylinder from the inside, is prevented from passing the film by its intense opaque background. But whenever the clear white lines of the map pass the beam, a bit of light will continue on through and falls on a sensitive photo-electric cell. The momentary flicker of light decreases the resistance of the thallium



On page 32 E.B. Calvert, chief of the forecast division of the United States Weather Bureau, can now see how his own weather maps look after they have traveled through the air. This photograph shows Mr. Calvert with the Jenkins radio-weather-map receiving set, which has just been installed in the Weather Bureau. Photograph by Harris & Ewing.

At left is an unretouched reproduction of a weather map, just as it was received aboard ship. The date is August 19, 1926.

sulphide cell and a light surge of current passes through. This surge is amplified by power amplifying tubes and in turn operates the giant control relay of the 40-kilowatt transmitter; it is very similar to ordinary key modulation. The wave is broadcast as an irregular series of dots and dashes which is very confusing to ship radio operators who try to decode them, not knowing what they mean.

The wave is received and amplified by an ordinary radio long wave set and is then passed on to the reproducer. It is further amplified by two UX-171 tubes in parallel. The receiving instrument is similar to the transmitter except that the operation is reversed, and the photo-electric cell is replaced by a pen or ink stylus. This pen is placed in front of the cylinder upon which is wound the sheet of paper used for producing the map. The radio impulses actuate the pen in the same manner that they operate the diaphragm of a telephone receiver.

The speed of the cylinder and the forward advance of the pen is held in synchronism with the transmitter by a very ingenious device. Proper synchronism was the critical point of development and until the discovery of how to control this, reproduction could not be successfully obtained. The synchronizing mechanism will not permit the receiver to run too fast or slow but will automatically check the cylinder at each revolution so that it will start off in harmony with each new revolution of the transmitting cylinder. This is accomplished by a synchronizing signal sent out at the beginning of a new revolution by the transmitting station.

Ship radio stations equipped with the Jenkins system may pick up the map transmission. This will mean much to navigation officers toward the intelligent handling of their vessels in all kinds of weather and providing for coming changes in the weather. The simplicity of the radio weather maps and their clearness of reception are such that they will prove of the utmost value to all navigation.

For many years, the Weather Bureau has been broadcasting every day a special weather bulletin, by means of which ship captains have been preparing their own weather maps at sea. The direct reproduction process provides for instant service and the elimination of the old coded method. The long familiar "USWB" weather bulletin, known to all operators since the early days of radio, may soon be a thing of the past. The Weather Bureau is now convinced that the day is not far distant when meteorological advices and information is available to all ships at sea by this direct reproduction method.

Weather On The Net

Richard DeAngelis
National Oceanographic Data Center

What about that tropical cyclone off Madagascar or the sea ice near Greenland? How's the weather for a stopover in Madrid or is the surf up in the Pipeline?

From an air-conditioned bridge, the comfort of your own home or the privacy of your office, you can get the weather anywhere in the world day or night if you have a PC and possibly a modem. It doesn't get any better than this for weather buffs and those whose livelihood is weather dependent.

Weather maps, satellite photographs, radar summaries, movie loops, upper air charts, forecasts, hurricane warnings– it's all on the Internet.

Once you have access to the Internet a whole new world of weather information can be printed, stored or just browsed. The Internet supplements facsimile and radio broadcasts.

Internet's roots go back to 1968 when the U.S. Defense Advanced Research Projects Agency began a small research experiment to find a way to connect various computers around the country. From this modest beginning, a worldwide network evolved and the Internet Protocol (IP) was born. Internet is easily visualized as an enormous network of computer hosts and communication lines, each linked in a web-like fashion. It is based on a small number of backbone networks, which are large, high-speed transmission lines stretching across the United States. These backbone lines provide service to the bulk of the Internet traffic by linking the various other component networks within the Internet. Thousands of wide area, regional and local networks connect to the Internet. To enable communications between the various computers and networks, a language or communication protocol that allows computers to speak among themselves was developed. It is known as TCP/IP– Transmission Control Protocol/ Internet Protocol. This package, which has to be in your system, usually comes with the modem or is available through freeware.

Considering the wealth of information you receive, Internet is a bargain. Unlike the phone system, it does not charge for long-distance service and unlike most commercial computer networks, it doesn't charge for access time.

Internet services include

Some Internet Tools and Terms

Telnet– An Internet protocol connection ("remote login") to a remote computer. Also the name of the program implementing the telnet protocol.

FTP (File Transfer Protocol)– Protocol that enables files to be moved from one computer to another over the Internet. Anonymous FTP is a feature that allows users to transfer files from a remote host without a local login. Anonymous FTP sites are established by organizations wishing to make certain files publicly available over the Internet. Information on the contents of FTP sites is available through the search capabilities of a database and a suite of related programs called Archie.

WAIS (Wide Area Information Server)– An Internet protocol and service that provides full text search and retrieval capabilities for Internet information resources.

Gopher– Software developed at the University of Minnesota (home of the "Golden Gophers") that provides flexible, menu-driven access to primarily textual information resources on the Internet. **Veronica** helps users find Gophers covering specific subjects by providing keyword searches of Gopher menus.

Mosaic– Software for implementing and browsing hypermedia information resources on the Internet. The opening screen of a Mosaic document document is called a Mosaic home page. Mosaic documents are multimedia and may include graphics, animation and sound as well as text.

World Wide Web (WWW)– The collective universe of Internet resources that can be navigated using hypermedia links. Much of the power of the Internet comes from the ability to move back and forth between different kinds of Internet resources, for example between Mosaic and Gopher servers.

e-mail, discussion groups, long distance computing and file transfers. Internet mail is somewhat like fax– electronic text. But you don't pay for it (at least not directly), and it is global in scope. The discussion groups, or *newsgroups*, are a world of their own. This world of news, debate and argument is generally known as USENET and at present there are some 2,500 separate newsgroups on USENET. There are fantastic amounts of free software available as well as library searches and CD-ROM catalogs. File transfers allow Internet users to access remote machines and retrieve programs, text and graphics.

What Do You Need

To get started you need a computer and physical connection to the Internet. This connection can take the form of a local area network or a modem. In addition to the TCP/IP installation, you will need a host machine somewhere. These hosts, often called Internet Access Providers, can be universities, commercial companies, government agencies and other groups with the appropriate resources. For those who have no contacts there is an organization called The International Internet Association that will help you access the Internet. They will provide you with an account, address and password which will enable you to send electronic mail as well as receive information. The cost to you is only the cost of an 800 telephone call to New Jersey where their host machine resides. For more information on this philanthropic group, write The International Internet Association, Suite 852, 2020 Pennsylvania Ave., NW, Washington, DC 20006 or fax a request to (202) 387-5546.

The Tools

Gopher and Mosaic are among the most powerful tools for exploring weather on the Internet (see box). While you can telnet to certain public access sites, these sites are busy and performance can be slow. The best way to use these tools is to obtain the appropriate software and install it on your own machine. Once again the cost is minimal. Public domain versions of the Gopher and Mosaic client software are available for many different platforms and operating systems including PCs running Microsoft Windows, UNIX workstations running the X Window System and Macintoshes. The various clients can be downloaded using FTP.

The most recent releases of the various versions of the Gopher software can be downloaded via anonymous FTP. To initiate this process, enter:

ftp boombox.micro.umn.edu
Login: *anonymous*
Password: your Internet address
Change to proper directory: *cd/pub/gopher*

Within the /pub/Gopher directory are several subdirectories containing various Gopher clients for different computer platforms and operating systems.

NCSA Mosaic Exploits Internet
By Kenneth Chang, NCSA Research Programmer, Publications Group

Click. Click. See an exhibit of dinosaur fossils on your computer screen. Click. Click. Listen to a half-hour speech by F.W. DeKlerk to the National Press Club. Click. Click. Watch a short movie showing the path of last year's Hurricane Bob. The age of a global information network arrived some time ago. Few noticed because there was no easy way to navigate through the nearly 10 terabytes of information--about 10,000 times more data than is found on a typical PC hard disk--that is publicly available on the Internet computer network.

NCSA Mosaic, the latest software offering from NCSA's Software Development Group, opens a portal to this cornucopia with a few clicks of the mouse. Click. Click. Read the text of a recent Supreme Court decision. Click. Click. Examine the latest satellite picture from the U.S. National Weather Service.

Built atop the World Wide Web technology developed by CERN (the high-energy physics laboratory in Switzerland), NCSA Mosaic is, in essence, HyperCard on a global scale. Each phrase highlighted in blue is a link pointing to related information, which can include text, images, sounds, and video sequences. For example, clicking on the words "dinosaur exhibit" could send you zipping through cyberspace to the exhibit on dinosaur fossils put together at Honolulu Community College.

"Mosaic is turning hypermedia into a medium that can be practically used," says Marc Andreessen, NCSA programmer of the X Window System version of Mosaic. "It's kind of like a '90s NCSA Telnet. Instead of logging into another computer, all of these computers on the network are able to give you information."

NCSA Mosaic for the X Window System was released in April. Since then, 5,000 copies a month have been downloaded from NCSA's anonymous ftp server. By the time you read this, Version 2.0 should be available, as should versions for the Macintosh and Microsoft Windows. NCSA Mosaic offers access to the more than 200 World Wide Web Servers, approximately 1,000 Gopher servers, and thousands of ftp servers, as well as WAIS databases and more obscure protocols. One of the greatest advantages of Mosaic, though, is that it combines all of these varied information servers into one unified information space. (That is, one rarely needs to know more than "click on the colored text" to effectively use the software.) In addition, Mosaic's Annotations feature enables one to attach personal notes to a document.

Applications for this new technology are still in the discovery stage. The National Consortium for High Performance Computing plans a Digital Library and Informations Systems Testbed, which will include such projects as an online library of medical images for the Human Genome and Human Brain Projects, archives of data from environmental monitoring satellites, and large datasets for social science research. Mosaic could be the software of choice for the testbed.

"NCSA Mosaic is driving the next stage of evolution of the global Internet," says Joseph Hardin, head of the NCSA Software Development Group. "What emerges will be a new form of life online." NCSA Mosaic is available via anonymous ftp from NCSA's ftp server. This software is free for individual use but is copyrighted by the University of Illinois. NCSA and the University of Illinois retain rights to restrict the modification and redistribution of this software.

NOTE: The Macintosh and PC-Windows versions of NCSA Mosaic were released in November 1993. Both versions are available on the NCSA Anonymous FTP server. Please read the copyright information.

The subdirectories also contain READ ME files that can be downloaded and that explain some of the procedures for using Gopher. (Note: When transferring software or executable files using FTP, always set the transfer type to binary mode by typing in *bin* at the FTP prompt. This does not have to be done when transferring text files such as READ ME documentation.) Comments or questions can be addressed via e-mail to:

gopher@boombox.micro.umn.edu

In a similar manner, information about Mosaic and the Mosaic software is available from the Mosaic team at the National Center for Supercomputing Applications (NCSA), University of Illinois at Urbana-Champaign. The Internet address for questions and comments is:

mosaic-x@ncsa.uiuc.edu

Current versions of the Mosaic client software for different platforms and operating systems are available via FTP from:

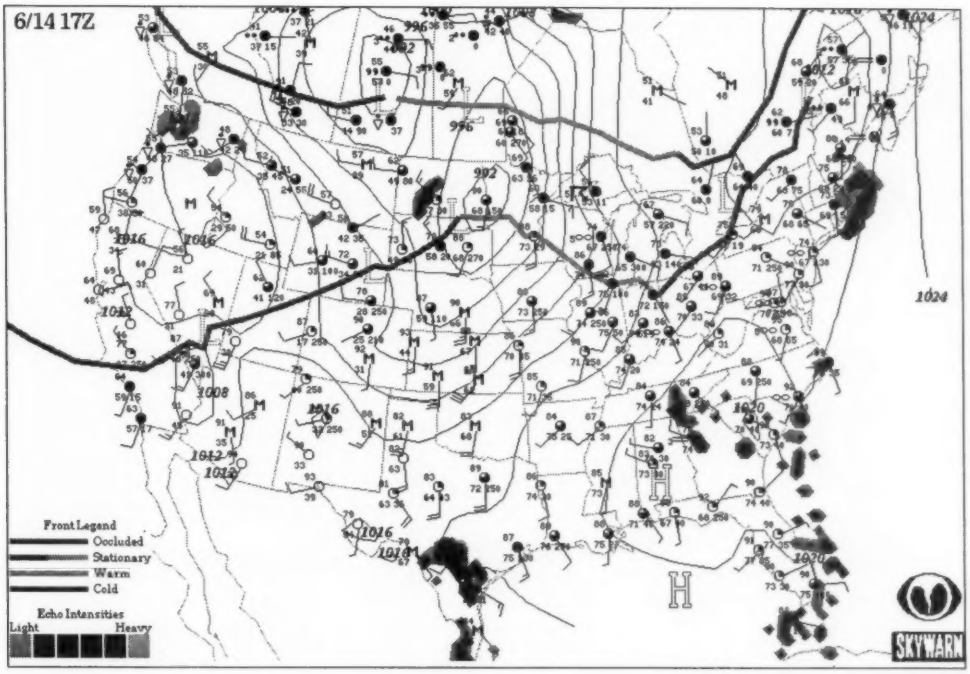
ftp.ncsa.uiuc.edu
in the directory */mosaic*

In order to view the graphics that Mosaic enables you to retrieve, you must have the proper software, such as as JPEG and GIF viewers. Once again, these are available free on the Internet and can be transferred to your machine via FTP just like the Mosaic and Gopher software. Once these are in place you are ready to surf.

Internet Weather

The best way to view weather on Internet is through Mosaic. Mosaic offers astounding color graphics and is very easy to use as a navigational tool. Gopher can be used as well, but most of the information via Gopher is text. If you don't have access to Mosaic you can still use FTP to transfer files of graphic weather information to your computer and then look at it and even print it if you want.

A typical Mosaic sequence would go as follows: A double click on the Mosaic icon brings up the home page at the NCSA of the University of Illinois at Urbana-Champaign. Mosaic is one of the client soft-



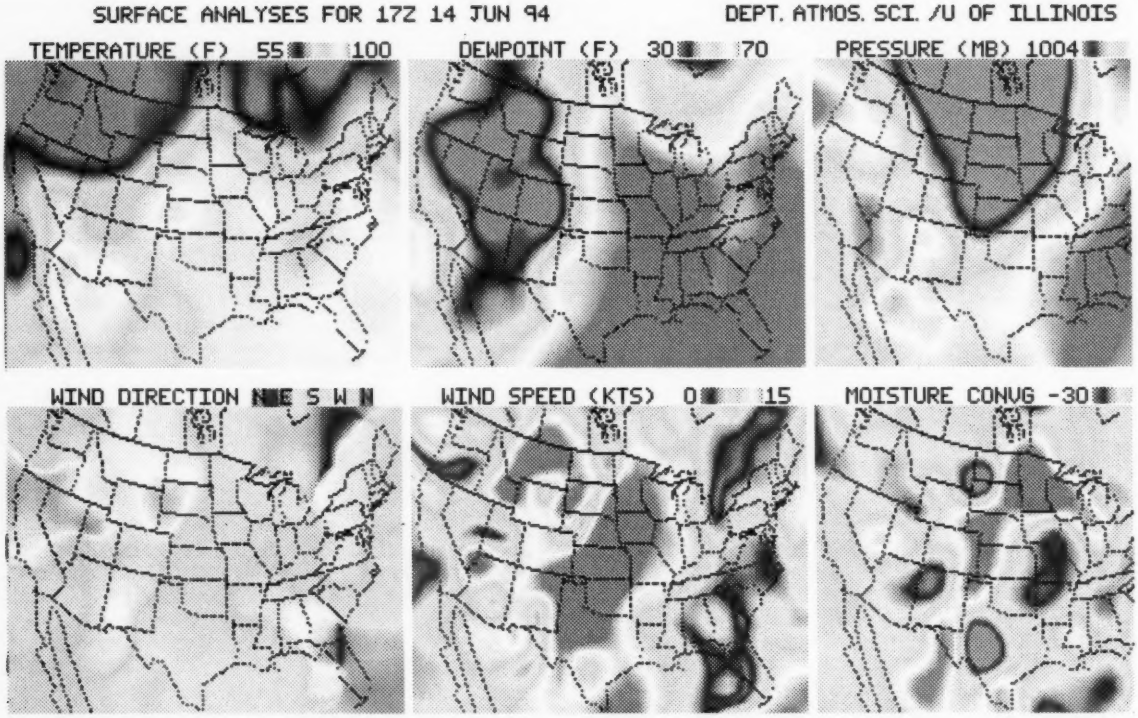
This U.S. Surface Analysis with the radar images overlayed was originally in color and the radar intensities are much easier to distinguish as are the fronts. This was obtained via FTP from the kestrel mirror site. Mirror sites contain data from other sites and help distribute the load on a popular single site. This analysis was originally produced at Southern Illinois University in a group headed by Chris Novy.

ware implementations of the larger project called World Wide Web (WWW) initiated at the European Laboratory for Particle Physics (CERN).

Next double click on any of the blue highlighted text to navigate. *World Wide Web* (WWW) will do nicely. Once into WWW, double click on the blue highlighted *subject* which leads to the WWW Virtual Library. Scan down the subjects to *Meteorology* and double click. Now the choices abound with such topics as satellite photos, maps, forecasts and other goodies. A double click on maps, for example, will give you a host of choices from around the world. Double clicking on US Maps from Michigan State University brings up a wonderful selection of maps, movies and satellite images provided from a variety sources including the University of Illinois, the University of Edinburgh, Scotland, NASA, NOAA and the University of Wisconsin. The folks at Michigan State's Unix Computing Group have assembled and converted these images into an easy-to-use, up-to-date package. You can view a six-panel movie of weather moving across the United States or any number of satellite images from GOES-8, GOES-7, Meteosat, GMS-4 and IR composites, including Antarctica Infrared Composites, which include data from six satellites. In addition there are radar composites, some of which are overlayed onto the current U.S. surface weather chart. Upper air charts are available as well. The Meteosat images covering the Atlantic and high resolution items are available from Africa and Europe as well. And this is just one choice from the WWW Virtual Library. You can try International Weathermaps from UCAR, forecasts from Australia, Weather of Canada from the University of Illinois, Weather Underground from the University of Michigan or NOAA satellite views of Asia from the University of Tokyo just to name a few. And don't forget this was just under the selection of maps—just one weather category. There is also a listing of Gopher and FTP Servers available under this category as well as the various WWW Servers. You can find climate information, storm reports and a host of other weather related items with a few clicks of the mouse.

So far in surfing the Internet, we have not seen Northern Hemisphere Charts and many other charts that are available to the mariner by facsimile, so this serves to supplement currently available information. However, Internet is in constant flux so it will not be surprising if more marine-related products show up.

How do you keep up with the changes and additions? There are several hardworking people on the Internet that do just that on a volunteer basis. For example, Ilana Stern from UCAR maintains the most extensive list of weather, oceanographic and climatic information available on Internet and updates it regularly. It is found in various locations under the title of Sources of Meteorological Data FAQ 1/2. Not only does it list the sites, but one section gives a brief description of just what it available at that site. It is one of the most useful weather documents ever produced on Internet. One example under the Purdue


SURFACE ANALYSES FOR 17Z 14 JUN 94
DEPT. ATMOS. SCI. /U OF ILLINOIS
TEMPERATURE (F) 55 100
DEWPOINT (F) 30 70
PRESSURE (MB) 1004
WIND DIRECTION N E S W N
WIND SPEED (KTS) 0 15
MOISTURE CONVG -30

This is a gray-scale rendition of a color graphic depicting a variety of weather parameters for June 14, 1994 at 1700 UTC. It was generated by the University of Illinois. It was obtained over FTP from kestrel and the charts are updated regualrly throughout the day. Kestrel is a mirror site mainly for the image and archives maintained by the Wxsat Mail list, which sends all programs, GIFS and messages via email. Subscribers receive bulletins about NOAA weather satellites and are invited to share information about observations, ground stations and the use of direct readout data received from these satellites. The Wxsat host system maintains an archive of messages up to 90 days old , images in GIF format and programs. Subscription requests can be sent to Rick Emerson at "wxsatrequest@ssg.com."

University WXP Gopher gives Stern's description: "This Gopher site includes satellite images, surface plots and analyses, upper air plots and analyses, soundings, radar, and plots of the results from various NMC forecast models..." The second part of this document is a list of CD ROMS that contain meteorological data.

Ilana works in the Data Support Section of the Scientific Computing Division of NCAR. She majored in Physical Science at the University of Maryland and meteorology at M.I.T. graduate school. Corrections, additions and comments can be sent to her at ilana@ncar.ucar.edu. Updates are available about every 2 weeks and can be obtained by a variety of methods. The most current copy can be obtained by anonymous FTP to *rtfm.mit.edu* from the file *weather/data/part1* in the directory */pub/usenet/news.answers*. If you can't use FTP, send e-mail to *mail-server@rtfm.mit.edu* with send */pub/usenet/news.answers/weather/data/part1* as the only text in the message (leave the subject blank).

There are other source documents as well and these will become apparent as you surf the internet. Also, we will be featuring a regular column on the Internet and what weather information is available starting in our next issue. There is a wealth of government information available through NOAA, NASA and other scientific agencies. The Internet is reminiscent of the Voluntary Observing Ship Program in that the cooperation of volunteers is what keeps it afloat.

Ilana Stern of NCAR has compiled several recreational FAQs including one on Alaksa travel. She bicycles to work nearly every day and also goes rock climbing, hiking and whitewater rafting. The vivacious Ilana is shown here with fellow NCAR scientist Gary Bates. Photo by Carlye Calvin.

Standard "C" Weather Observations and SafetyNet

John A. McDonald
National Weather Service

It seems that the more things change the more they stay the same. INMARSAT Standard "C" is being implemented and the use and configuration of new equipment are again making the news. A source of some confusion has been the use of code 41+ for the transmission of weather observations to the National Weather Service (NWS). Included in the two tables are the set up instructions for two manufacturers of Standard "C" equipment to help alleviate some of the confusion (more will be added as they become available). In the Standard "C" software, the code 41 is considered a Special Access Code or a Special Code.

HOT OFF THE PRESS

During the eleventh session of the Commission for Marine Meteorology (CMM-XI in Lisbon, Portugal, April 1993) the Netherlands graciously agreed to supply and maintain software for the compilation, encoding and transmission of SHIP reports through INMARSAT-C (by using the messaging channel), and actions are already underway to make this software available for installation on Voluntary Observing Ship Program (VOS) ships equipped with INMARSAT-C. The Commission also urged members operating VOS to make every effort to install this software on their ships as they became equipped with INMARSAT-C, for "the general benefit of the whole of WMO."

To run the TURBO1 software requires a DOS personal computer, with at least 410 kb free working memory and a 3.5-inch disk drive. The manual, together with the software itself, provide all the necessary instructions for its use.

As noted at CMM-XI, the software was developed and very kindly made available to WMO by the Royal Netherlands Meteorological Institute (KNMI). KNMI have also agreed to maintain the software and to provide WMO with updated versions, for distribution by the Secretariat as appropriate.

The software has three objectives:

(a) To compile ships' meteorological reports in standard SHIP code and prepare them for transmission as a standard telex message through the messaging channel of the INMARSAT-C system;

(b) To store the report on the diskette for later retrieval, further quality control and permanent archival for climatological purposes;

(c) To perform simple quality control on the report prior to transmission and storage.

It may be noted that by no means are all ships yet equipped with INMARSAT-C terminals, nor are many INMARSAT Coast Earth Stations able to use the short code 41 dialing procedure with INMARSAT-C to direct SHIP reports to National Meteorological Services. However, the numbers of both ships and CES with these capabilities are expected to increase rapidly over the next few years. Where necessary, training of ships' officers should be arranged in the use of the software.

In January 1994, COMSAT began C-Link for INMARSAT-C service in the Atlantic Ocean Region-East. The earth station ID (DECIMAL) is "101." C-Link provides the same satellite services as it does with other INMARSAT satellites.

Manufacturers with information on INMARSAT-C programs for the transmission of weather observations not included in this article are requested to please contact John McDonald at NOAA, NWS, SSMC2, W/OSO151, Station 17406, 1325 East-West Highway, Silver Spring, MD 20910 or at 301-713-1931.

Another important function of INMARSAT Standard "C" is the Global Maritime Distress and Safety System SafetyNET service. SafetyNET provides for the dissemination of maritime safety information to ships at sea via INMARSAT-C satellite communications. Maritime safety information (MSI) includes NWS High Seas Warnings and Forecasts, USCG Search and Rescue messages, DMA Navigation Warnings, and other safety information.

HOW TO SEND A WEATHER MESSAGE FROM A MOBILE TERMINAL (USING SPECIAL CODE 41)

STEP 1 The first time you send a message, you must store the Code 41 (Meteorological Message) address in your mobile terminal.

Thrane and Thrane - software 1.4 or greater (upgrades are $150- $250, if you have earlier versions).

press F-3 to open address book
select New
type in new name – Example: Meteorological

on the right hand side of the page the dot is in front of the Telex [(•) Telex], to move the dot to Special, **arrow down** (⇓) to place the highlight on special and press the spacebar (the dot will now be in the (•) Special box)

press **ENTER**
at the bottom of the screen a box will appear.
enter the number 41 and press **ENTER**.
set the bit to 7 if it is not already done
press **ENTER**

Trimble - software 2.12 or higher (upgrades at minimal cost)

from main menu screen
select: **S**Etup
select: **M**ail address
select: **I**nsert mail address
if the Address List appears,
press **ENTER** (the Edit Address screen will appear)
use the arrow keys to select the Prefix Field
(Type 41 into this field)

leave the Country Code, Destination, and Extension fields blank use the arrow keys to move the cursor to the CES field,

press **ENTER**

select the proper CES from the list displayed. Move the cursor to the desired LES and press

ENTER
use the arrow keys to select the Delivery Network field
press **ENTER**
select SPCL ACCESS CODE with the cursor
press **ENTER**
press **ESCAPE** to exit the Edit Address menu, continue to press
ESCAPE until program returns to the main menu

The code 41 is now saved in the address book and is available for transmission of meteorological observations.

EB NERA - software 1.54 or higher (has been out for three years).
At present it is unknown if other manufacturers support the 41 code capability. An attempt is underway to get a list and contact as many as possible for information on their capabilities.

STEP 2 The message should now be entered beginning with the BBXX and typing all characters from the log sheet. After entering the information, select transmit and the address you entered in Step 1. Remember to select no confirmation.

The message has now been transmitted.

HOW TO SEND A WEATHER MESSAGE FROM A MOBILE TERMINAL (WITHOUT SPECIAL CODE 41)

If your Mobile Earth Station does not have software support for a Code 41 message, you may be able to use the following method.

Choose the destination you wish to address the message to from the list below.

DESTINATION NUMBERS

MODE	AOR-W	POR	AOR-E
TELEX	194999999	192999999	192999999

Because the formal destination is addressed to the C-Link Dial-in system, another address must be designated on the first line of the message indicating the Cbox address where the message is being sent. This is also known as two-stage addressing. For example, the address A=41 is the Cbox, use one of the numbers listed above in the destination field, and then on the first line of text in the message, the following text should always be the first entry of the message:

*R=(N=6,A=41) (press return or enter key)
BBXX.....etc

As noted above, the BBXX message starts on the second line. The message is first routed to the Land specific Cbox as indicated in the first line of the message text.

Note, in all cases, that weather observations are sent as Telex and that confirmation should **NOT** be requested. The unneeded confirmations cost the government an additional amount that could be used more wisely elsewhere. **Confirmation must be turned off each time you send a meteorological message. At some point in fiscal year 1995, COMSAT will be notified that confirmation will no longer be authorized and this may result in return billing to the ship.**

Presently, the NWS High Seas Bulletins for SafetyNET broadcast are prepared by the National Meteorological Center's Marine Forecast Branch in Camp Spring, Maryland and the National Hurricane Center in Miami, Florida. The Bulletins are entered into the NWS Automation of Field Operations and Services (AFOS) and the National Oceanic and Atmospheric Administration (NOAA) Weather Wire Service (NWWS) uplink. The NWWS link provides weather information via satellite to points around the country. Data checking for integrity is done at GTE/CONTEL Land Earth Station (LES) in California. All Bulletins are then forwarded to U.S. Coast Guard (USCG) Communications Station, Chesapeake, Virginia, which then relays them to the COMSAT SafetyNET Server, by way of the USCG X.25 network, for delivery to either COMSAT Coast Earth Station (CES) Southbury, Connecticut or Santa Paula, California. The CES's transmit the NWS High Seas Bulletins to the proper INMARSAT Network Coordination Station which ensures that the messages are delivered to the proper GMDSS METAREA for receipt by ships equipped with INMARSAT-C equipment.

In case of a failure in the fairly complex SafetyNET network, the NWS SafetyNET products will be delivered to the SafetyNET Server via the X.25 protocol line to the USCG rather than by the NWWS link to USCG in Chesapeake, Virginia. This modification will help simplify and ruggedize the SafetyNET dissemination network.

See the related GMDSS SafetyNET article on page 18.

Biloxi Lighthouse

Elinor De Wire
Mystic Seaport Museum

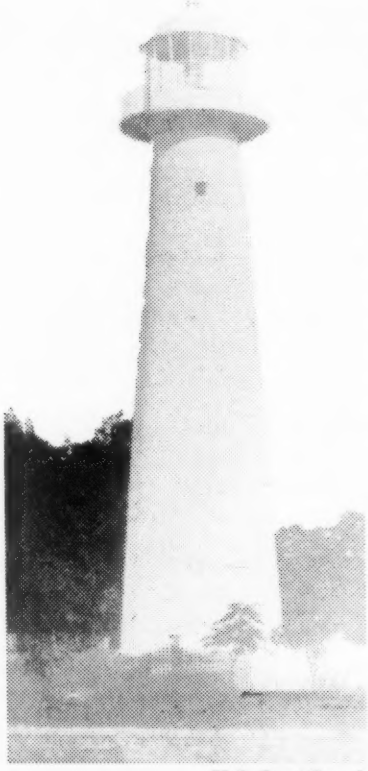
Mississippi's Highway 90 has an unusual traffic light at which no motorist is required to stop, yet many do. It's the 146-year-old Biloxi Lighthouse, which stands in the grassy median strip where the highway skirts by Mississippi Bay. This parcel of historic ground was part of the Old Spanish trail that linked Florida to California in the years before American colonization. Later, it became the capital of the French Province of Louisiana, better-known as the Louisiana Purchase.

Biloxi Lighthouse was built in 1848 to serve the Gulf of Mexico's lucrative shrimp and oyster fleets, as well as schooners bringing timber down the Tchouticabouffa River estuary. The lighthouse, prefabricated in Baltimore then shipped in sections to Biloxi, is thought to be the first cast-iron sentinel built in the south. The 19-meter (61 foot) tower was lined with brick and bolted to a stone foundation. Nine brass lamps with reflectors served as a beacon, which showed a distinctive three-second flash.

Six years after its completion, it was necessary to build a seawall around Biloxi Light. Storms and high tides had eroded the beach and threatened to undermine the tower. In 1854, the first of three women to keep the lighthouse arrived.

Mary Reynolds, a Baltimore native and mother to a small band of orphan children was appointed with the help of her good friend and Mississippi senator, Albert Gallatin Brown, whose family had intimate ties to the Lighthouse Service.

Reynolds' income was $400 a year, considerably less than men were paid for the job, but among the better salaries for women of the day. By all reports, Reynolds was an excellent lightkeeper and, with the help of her children, kept the station in good repair. Their life seems idyllic. Days were spent fishing, swimming, and boating. Balmy breezes blew in off the gulf, and the scent of camellias wafted through the air.



U. S. Coast Guard.

But there was a darker side to a life there too. Biloxi Light stood watch in Hurricane Alley, where severe storms slammed the Mississippi coast about once a decade. After the destructive 1860 storm, Reynolds told Mississippi's governor, "I ascended the tower during and after the storm, when men stood appalled at the danger I encountered."

During the Civil War, Biloxi Light was extinguished to prevent it from aiding Union forces. Mary Reynolds remained at the lighthouse though there was no work to do. Ironically, she devoted her time to sewing clothing for Confederate soldiers while watching over the federal supply of oil and equipment in the lighthouse.

In 1866 Reynolds was replaced by Perry Younghans, who probably had the right political connections. (Lightkeepers positions were politically controlled until Grover Cleveland's presidency.) Younghans died only a year after his appointment and was succeeded by his wife, Maria. She cared for the tower's new beacon, a fifth-order Fresnel lens illuminated by lard oil lamps.

This lighthouse has survived many Gulf of Mexico hurricanes over the years. In September of 1855 a hurricane wreaked havoc from Proctorville to Biloxi. As reported by Captain Frost of the mail steamboat ***California****: "Pass Christian, Bay St. Louis, Mississippi City and Biloxi, everything accessible to injury by storm is gone, with the exception of two wharves at Biloxi."*

About this same time, the lighthouse was painted black. Rumors quickly circulated that the daymark was a drape of mourning for President Lincoln and a woeful reminder of the death of the Confederacy, for Beauvoir, the home of Confederate president Jefferson Davis, sat just behind Biloxi Light. It's more likely the color was intended to make the lighthouse show up against the the tawny beach in bright daylight. Regardless, the color lasted only a few years before the government restored the tower's white daymark.

Maria Younghans and her daughter, Miranda, proved themselves capable lightkeepers despite repeated tests of their fortitude and skill. In 1867, when erosion caused the lighthouse to lean, the two women managed to keep the beacon lit while workers dug away at the foundation to right the tower. They also kept the light going during the hurricanes of 1870, 1888, and 1893.

A 1916 storm hurled a pelican through one of the lantern windows and tore up the breakwater, causing severe flooding in the Younghans' house. The women installed a temporary window and restarted the revolving lens. Though the tower groaned and trembled mightily during the worst hours of the storm, they did not abandon it. The danger was real, for only a decade before the 1906 hurricane had killed the keepers of nearby Sand Island Lighthouse and completely destroyed the tower.

After Maria Younghans retired in 1919, Miranda Younghans took over the light and served another 10 years during which time the lighthouse was electrified and tourism began to increase. By 1948, when the lighthouse celebrated its 100th birthday, it had been automated and the keeper's house was home to the Biloxi Chamber of Commerce. The citizens of Biloxi honored the lighthouse with a brief ceremony and a fresh coat of white paint.

In 1969, Hurricane Camille destroyed the lightkeeper's house, but Biloxi Light stood firm. Minimal repairs put it back in service as a navigational aid. Today it is operated as a private light by the city of Biloxi.

D–Day Weather

Howard Cohen
Defense Mapping Agency

U.S. Naval Institute

This year marks the 50th anniversary of what has historically been known as "the longest day" during World War II. It was in the darkness of the early morning hours of June 6, 1944 that the British 6th, U.S. 82nd and U.S. 101st airborne divisions dropped beyond the beaches to destroy enemy forces and to cover the deployment of seaborne assault troops. Simultaneously, Allied naval forces swept the English Channel of mines and preceded the assault vessels to the landing areas. At 6:30 a.m., under the cover of naval gunfire and air bombardment, six U.S., British and Canadian divisions landed in the greatest amphibious assault in recorded history.

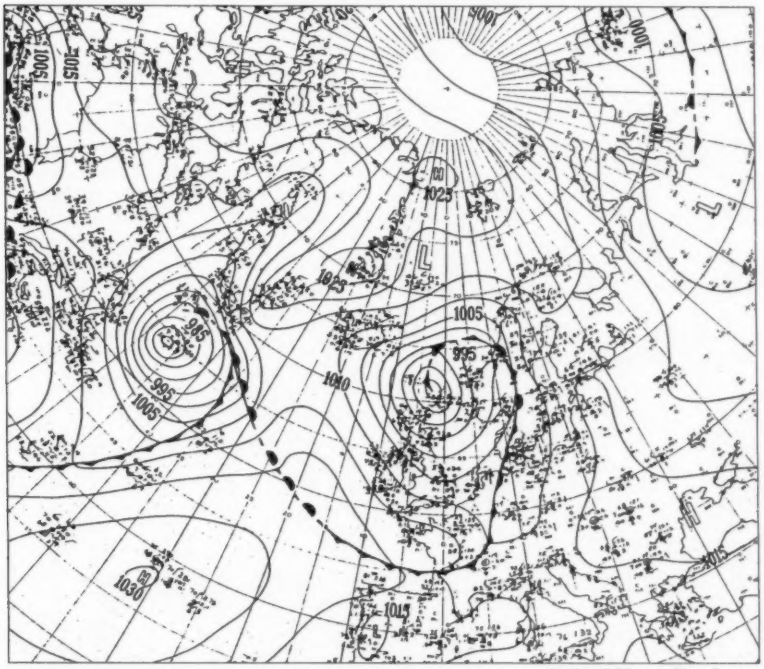
Much is remembered of this longest day, but what role did weather play, and how did it affect General Dwight D. Eisenhower's decision to launch the assault that would bring the end to the war in Europe?

The original D–Day was scheduled on June 5, however, the forecast on the 3rd indicated unfavorable conditions. Of all months, June 1944 experienced the highest winds and roughest seas in the English Channel for 20 years.

On the morning of the 4th, Eisenhower decided that a delay of at least 24 hours would be necessary. By that time, part of the American forces were already in the Channel. Due to the heavy seas, all the vessels were forced to return and seek shelter.

Conditions in the Channel during the morning of June 5 showed no moderation. Reports for the following day contained a slight ray of hope. A break in the weather starting late on the 5th through the next morning was predicted– decreasing winds and scattered clouds, with not less than a 914–meter (3,000 foot) ceiling. These conditions were not to last for long. Toward nightfall, a return of increasing winds and high seas for an indefinite period was on the horizon.

Owing to tide considera-



National Climatic Data Center

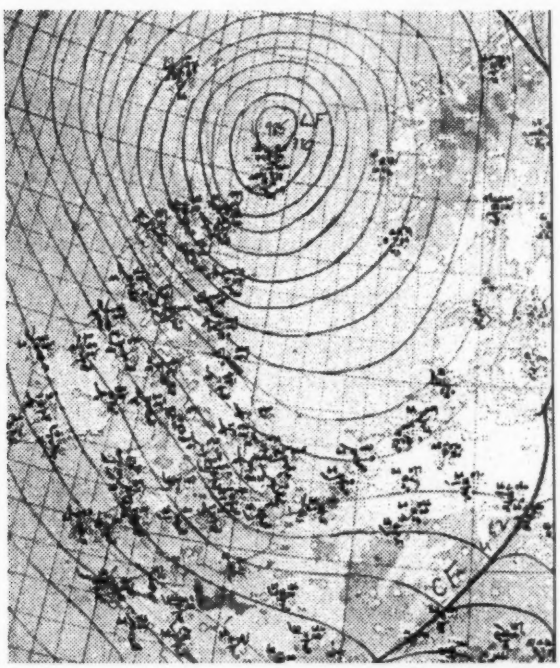
General Eisenhower originally set June 5th as the date for the assault in the west, "subject to last-minute revision in the event of unfavorable weather." The Northern Hemisphere Surface Chart for 1230 UTC June 5, 1944 (left) indicates the weather was unfavorable. At 1930 UTC on the 3rd, Group Captain Stagg told "Ike" that the weather would be too bad for landings on the other side of the Channel on the 5th.

Below, left is the forecaster's working surface chart for 0100 UTC on June 6, 1944, plotted in the Central Forecasting Office at Dunstable. At this time the airborne troops were landing in Normandy with no weather problems. Deciphered observations from France were available. The cold front, which would have prevented effective air support of a seaborne landing on the 5th, had moved to the southeast.

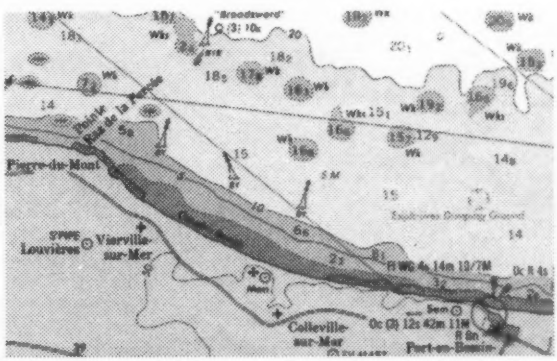
On the DMA navigational chart of Omaha Beach, (below) some monuments serve as navigational aids for mariners. They are often abbreviated to "Mon" and placed near a position circle.

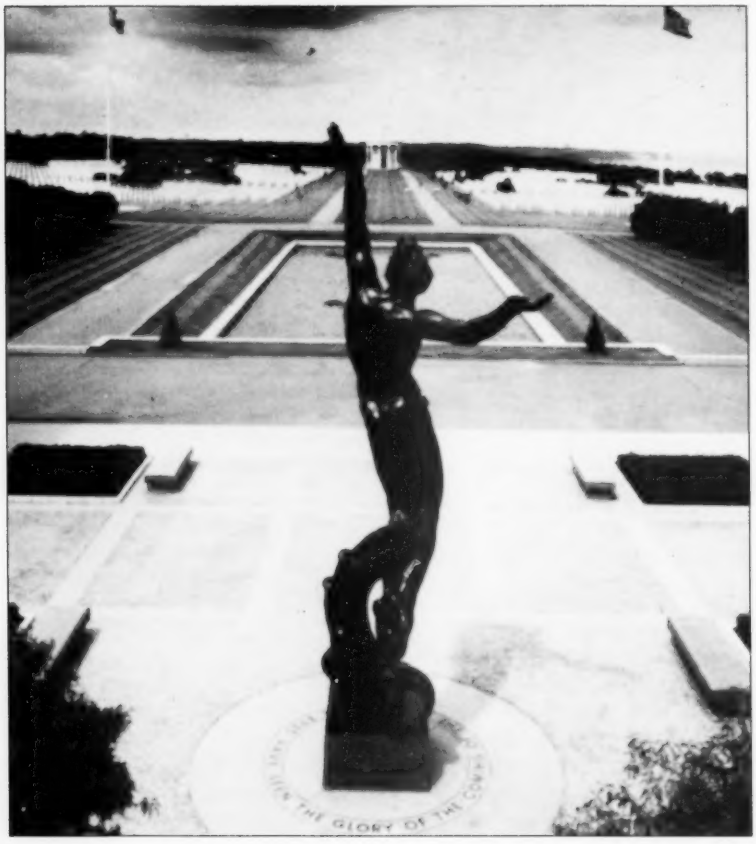
tions, the latest possible date for the invasion was June 7. However, this 24-hour adjournment was infeasible since naval bombardment forces that had sailed from northern bases on the 3rd would have to pull back to port for refueling. If that happened, the entire schedule of the plan would be off. Eisenhower was faced with a choice between the risks of an assault during a partial and temporary break in the poor meteorological conditions or putting off until the tide and moon was just right again several weeks later. He decided that a postponement would be bad for morale of the troops and would represent a loss of tactical surprise. At 0400 hours on June 5th, General Eisenhower made the final and irrevocable decision– the invasion of France would be the next day.

On D-Day, the wind had moderated and the cloud cover was well broken with a base of 1,219 meters (4,000 feet) or higher. These conditions allowed aircraft



U.K. Meteorological Office





The 6.7-meter (22 foot) bronze statue, "Spirit of American Youth," stands in the center of the Normandy American Cemetery and Memorial, overlooking Omaha Beach. This monument appears on the navigational charts. It was constructed in 1947 as a tribute to the Allied forces who stormed the beaches of Normandy. The memorial consists of a semicircular colonnade with an area at each side, which contain large maps and narratives of the military operations. Behind the memorial structure is the Garden of the Missing. Its semicircular wall contains the graves of 9,386 soldiers, most of whom died during the landing and ensuing operations.

Another charted position circle of interest is France's Brest Naval Monument. Brest was a major base of operations for American naval vessels during World War I. Overlooking the harbor, this monument commemorates the achievements of the U.S. Navy during that time. The original was destroyed by the enemy on July 4, 1941, prior to our entry into World War II. The present structure is a replica of the original and was completed in 1957. The monument is a rectangular shaft, rising 44 meters (145 feet) above the lower terrace. Sculpture of nautical interest adorn the four sides of the monument.

to have visual bombing opportunities of the shore defenses, clearing the way for the amphibious assault landings. The sea was still rough and many soldiers were sick during the crossing. The high waves also caused some of the major landing craft to fall behind.

The unsettled weather was chiefly responsible for the surprise of the invasion. Also, no U-boats were present that day, and the bad weather caused the enemy surface patrol boats to return to port.

The enemy thought that any Channel crossing would be impossible with the sea conditions so rough. With German radar tracking stations knocked out during bombing attacks, coupled with the unexpected Allied arrival, the anticipated difficulties were more than offset.

Another German miscalculation was the supposition that the inevitable invasion would occur only with a full moon during high tide. The location was predicted to be within the general vicinity of a good harbor that avoided cliffs and dangerous shallow waters. The invasion happened shortly after low tide when the moon was full. As history shows, the landing was away from any large harbor; some points of attack were beneath sheer cliffs; and the water to the beach was blocked by reefs, man-made obstacles, and strong currents. German naval experts thought these conditions to be impassable for any landing craft.

With a little cooperation from Mother Nature, the Normandy invasion got under way. After nearly two months of confinement to the beachhead area, the Allies finally broke into the open and moved toward a victory that would occur 11 months later, when Germany capitulated.

Though heavy casualties were taken, they were not as high as expected, thanks in part to the surprise that day of June 6, 1944. General Dwight D. Eisenhower said in his July 13, 1945 report to the combined chief of staff on the operations in Europe, "All of them died in the spirit of unity which joined the Allies in our common ideals. To them, and to those who bear the wounds of war, we, their comrades in arms, render most grateful and humble tribute."

Whatsa MAREP?

A MAREP (Mariner Reports) is a radio message of weather and sea conditions observed by mariners at sea. How does this differ from the VOS program?

Marine weather observations are provided by satellite imagery, sea-going merchant ships (VOS), automated buoys, offshore platforms, the U. S. Coast Guard and others. But there are many gaps in the reporting network, particularly in the near-shore zones, out to about 200 miles, and on the larger inland lakes.

To help improve the quality of marine forecasts in these areas the National Weather Service established a nationwide Mariner Report Program– MAREP. Through this cooperative effort, professional mariners report timely observations of sea conditions for their area through volunteer shore stations. In return, the shore station provide mariners with up-to-date warnings and forecasts.

This is a vital effort in promoting marine safety and efficiency. In the 17 odd stations around the country, volunteers like Josie Dyas, Peggy Dyson and the

MARINER REPORTING CYCLE.....
Individually, fishermen contribute marine weather observations through their cooperative organizations. Collectively, they benefit from improved forecasts aired 24 hours a day over NOAA Weather Radio, a direct broadcast system operated by the National Weather Service.
NATIONAL WEATHER SERVICE

One of the best MAREP reporters on the Great Lakes is the Head boat ***Linda Mae*** *(right) owned by Captain Dennis Zukowski and his wife Lyn. They have been reporting faithfully for about 5 years. The* ***Linda Mae*** *operates out of Wildwood State Park on the east side of Cleveland.*

Below is the vessel American Eagle an early MAREP reporter in the Delaware Sea Grant operated program.

Delaware Sea Grant relay mariner's reports from near-shore zones providing a vital link between the mariner and NOAA. NOAA's position on MAREPs is unequivocal– "All observations are useful."

In general MAREPs identify a vessel, its time, location, the wind direction and speed, the height of sea/swells, visibility, barometer, air/sea temperature and other general remarks that might benefit both the sender and other mariners. MAREPs fill in spaces between the occasionally widely separated weather reporting merchant ships and buoys and help to identify local conditions that might otherwise go undetected allowing NWS to relay news of a sudden storm to boaters, fishing crews, and others who depend on weather information. MAREPs can confirm as well as update or correct marine forecasts and warnings.

"MAREP participants are vital to a marine forecasting data base in Lake Erie," says PMO George Smith. "We can't afford to have as many automatic observing systems on the lakes as we need or would like. So we must enlarge this program and convince those who are the end users of our products that they must also help to build these into more reliable products. MAREPs are our ground truth so to speak, it will enhance all of the new tools we are receiving under modernization."

Josie Dyas— MAREP Personified

Josie Dyas' suburban home is anything but typical– the front bristles with antennas for CB, VHF with direction finder, single side band and wave rider buoy radios, a cup and vane anemometer, and a reinforced tower with Coast Guard emblem affixed. Inside her living room/operations center are radio transceivers, a modem and printer for receiving the forecasts, the wind readouts and barometer. Nearby, equipment for her use was installed by Scripps Institution of Oceanography.

For more than 14 years, Josie's been exchanging weather information between mariners off the Washington coast and the National Weather Service (NWS) Forecast Office in Seattle. Even longer than that, Josie has worked via radio from her Westport, WA home in assisting the local Coast Guard Station with search and rescue cases, often using CB radio. On several occasions, she has monitored her radio for more than 36 hours helping small boaters find their way back to port in dense fog.

Before Josie, communications from the Washington coast mariner to the NWS were difficult and infrequent. Boaters had no convenient way to alert the Forecast Office that winds and seas were building faster or higher than expected. This type of information forwarded rapidly through Josie's home weather station has resulted in a significant number of advisory and warning updates and improved safety and efficiency.

While still a practicing nurse, Josie and her husband Ken fished the waters off Westport. After Ken retired, they fished full time until back injuries forced Josie to stay ashore. At first she talked to Ken via CB, then to friends in other boats and later she began to work with the Coast Guard in distress assistance.

Today Josie solicits observations from fishermen, tow boats operators, harbor pilots, Coast Guard patrols and recreational boaters. In return, she broadcasts each forecast and warning for the Washington coast, both scheduled and updated, shortly after issuance by the forecast office. Josie is also an invaluable communications link to the Forecast Office for other types of information as well: casualty and damage reports, changes in fishing season regulations and general information exchange with the marine community.

Using Scripps interface equipment, she receives data radioed from a waverider buoy, just outside the Grays Harbor entrance, which displays wave height, direction and period along with water temperature and sends them by phone to the processing computer in La Jolla, California. This information is also passed to the forecast office along with any weather reports during the regular three-a-day telephone calls.

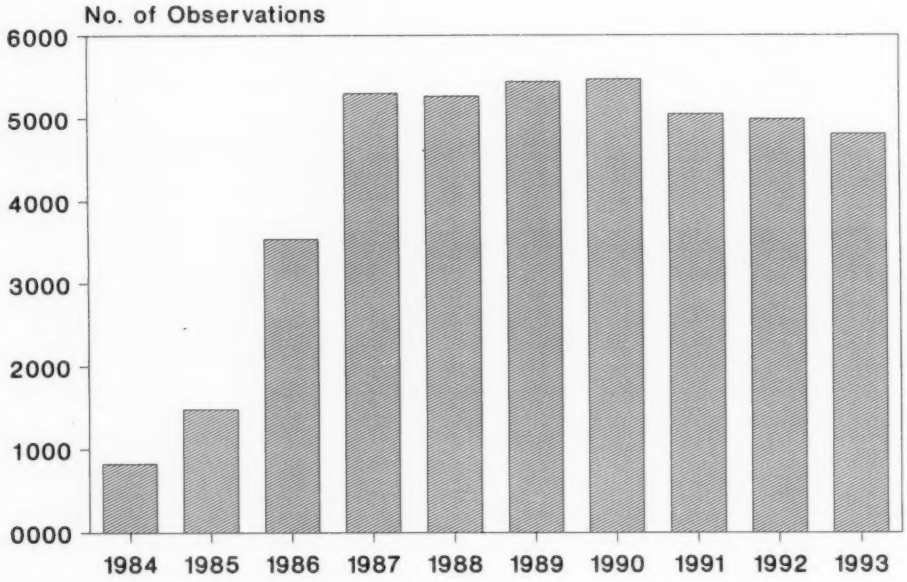
Josie's nursing background, former experience on the water and her developing radio skills made her a natural communication link and her efforts continue to garner praise. She was recently presented a national public service award by the National Weather Association for her invaluable role in assisting Pacific Northwest mariners and the NWS Marine Forecast and Warning Program.

In early 1980, the Seattle NWS Forecast Office looking for an efficient way of getting weather an sea condition reports from coastal mariners, proposed a cooperative effort with her. Josie wasn't sure how it would work but was willing to try. Since then, the program has continued to grow as has an extensive array of awards from local fishermen, Coast Guard, National Weather Service, State Department of Fisheries and local Professional Business Woman's Association

Bob Anderson
NWS, Seattle

The chart at the right indicates the fairly consistent number of MAREP observations over the past decade. Note that the first few years contained less than 12 months of observations. These numbers are excellent and are a good indication of the quality of the Sea Grant program in general and the Delaware program in particular.

Total Annual MAREP Observations
Lewes, DE (1984-93)



1984- 5 months; 1985- 9 months

The Lake Erie program uses several commercial fishing vessels called "Head boats" to generate forecasts. Head boats, ranging about 12 to 24 meters long, are for the most part walk-on charter boats out on the water every day. They routinely call in plain language weather reports to the various Coast Guard stations along the shore who in turn relay the reports to the NWS. Ohio EPA and Department of Natural Resources vessels also participate. The program will be expanded to the other Great Lakes with the arrival of full-time PMOs in Cleveland and Chicago.

In Washington state the Astoria MAREP program began in January 1993 with VHF capability only. A Single Sideband radio was added in February 1994. The station call sign for "Astoria Weather" is WXN-76. This license was originally issued back in 1978 to monitor conditions over the Columbia River bar and was expanded in 1993 to include VHF marine channels 68 and 69 and a year later for Upper Sideband frequencies 4125.0 kHz and 4146.0 kHz.

Reports are made at 7 A.M., 1. P.M. and 7 P.M, but the equipment is left on 24 hours a day for mariners experiencing "un-forecast weather conditions." Astoria Weather to date has received 773 reports of wind and sea conditions—one or two times a report has come by cellular phone—and instantly relayed on AFOS to marine forecasters in Seattle, Washington and Portland, Oregon. Similar efforts for a MAREP program have started in the Eureka Office in Northern California.

For years Peggy Dyson in Kodiak, Alaska has provided support to the NWS by relaying weather observations from the Alaska fishing fleet and keeping the fleet updated with warnings and forecasts issued by forecast offices statewide. Dyson, who operates station WBH29 on 4125 kHz, makes her radio calls at 8 A.M. and 6 P.M. local time, 7 days a week. She is also available on an emergency basis around the clock.

Today MAREP stations circle the country although more are needed. In October 1990, stations were listed from Boston, Massachusetts to Barrow, Alaska providing local observations that can spell the difference between a safe voyage and a hazardous one.

OBSERVING THE WEATHER AND CLIMATE

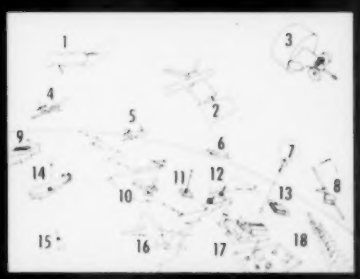
Artist: Trevor Ruth

Poster Courtesy of:
Australia Bureau of Meteorology
and
The World Meteorological Organization

OBSERVING THE

World Meteorological Day is observed on 23 March each year to commemorate the establishment of the World Meteorological Organization on that day in 1950.

'Observing the Weather and Climate' – the theme for World Meteorological Day 1994 – is a core responsibility of the National Meteorological Services of the world. This artist's impression of the global observing system of the 1990s shows some of the key components of the international infrastructure for round-the-clock observation of the global atmosphere and oceans.



1. Polar-orbiting meteorological satellite
2. Polar-orbiting earth resources satellite
3. Geostationary meteorological satellite
4. High-altitude research aircraft
5. International aircraft
6. Meteorological research aircraft
7. Radiosonde
8. Pilotless aircraft
9. Baseline air pollution station
10. Meteorological satellite ground station
11. Automatic weather station
12. Automated river-height and rain-gauges
13. Wind profiler
14. Voluntary observing ship
15. Drifting buoy
16. Domestic aircraft
17. Meteorological observing station
18. Over-the-horizon radar

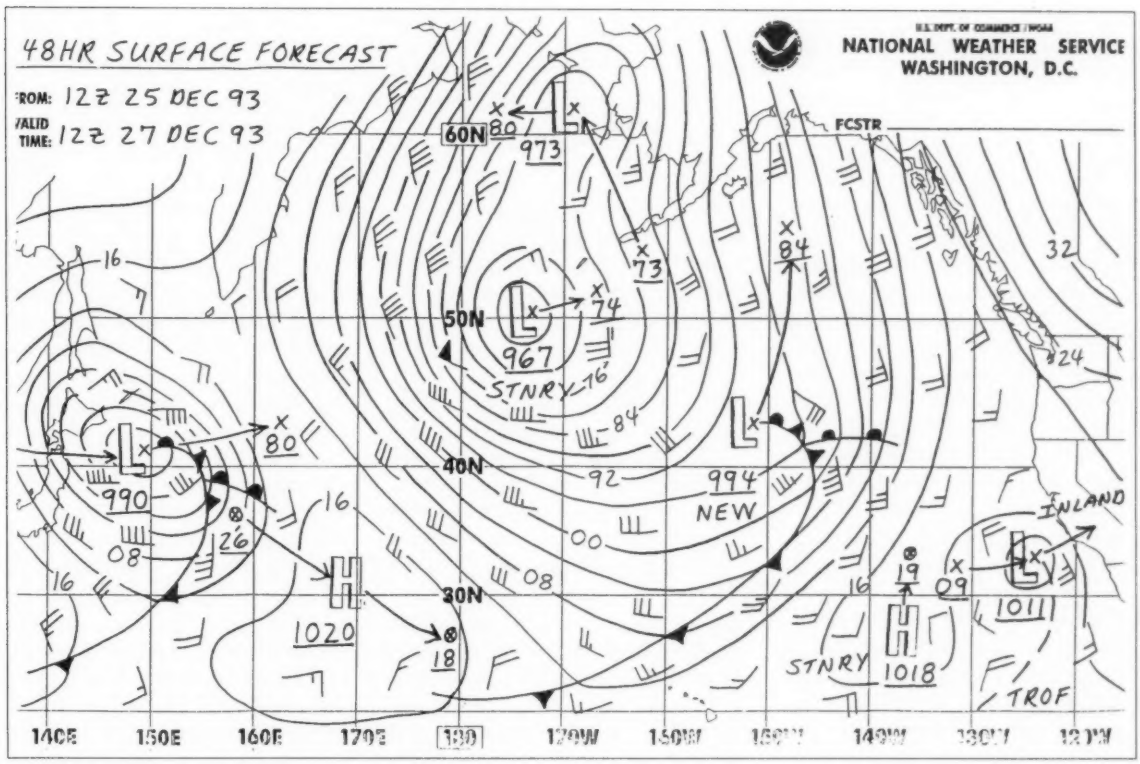
WORLD METEOROLOGICAL ORGANIZATION

BUREAU OF METEOROLOGY
DEPARTMENT OF THE ENVIRONMENT, SPORT AND TERRITORIES

E WEATHER AND CLIMATE

The 48-hour Forecasts

Lee Chesneau



These forecasts will be generated twice each day (00 UTC and 12 UTC) for each ocean and are based on the 00 UTC and 12 UTC model runs. These forecasts depict surface isobars (2 digits in increments of 8 millibars), wind speeds in knots (increments of 5 or 10 knots wind-barbs), forecast positions of synoptic scale highs and lows including 24-hour track history (24 hour forecast) and 24-hour forecast projection (72-hour forecast), and forecast of frontal systems (occluded, warm, and cold). The tracking history and 24-hour projection of highs and lows extends the time usage of the product. This forecast product can enable vessels to make course and speed adjustments to avoid the heaviest forecast conditions or minimize the ship's duration of encounter of heavy weather. The timely issuance of the 48-hour surface forecast will certainly aid in crew safety, minimize ship or cargo damage, fuel economy and maintain schedule.

NOAA's Oceanographic Atlantic Radiofax

Jenifer Clark
National Ocean Service

There are 11 ocean charts available on the Atlantic radiofax. The following is a description of each chart and a transmission schedule.

Chart 1 (right) is the North Panel (NP) Ocean Features Analysis derived from the NOAA polar orbiting thermal infrared satellite imagery. It is produced three times per week and the data resolution is 1 to 5 kilometers (1/2 to 2-1/2 miles). This chart covers the area from the East Coast near Cape Hatteras and east to 45°W. It shows the location of the Gulf Stream, clockwise circulating Warm Eddies, counterclockwise circulating Cold Eddies, continental Shelf Water and continental Slope Water. Sea surface temperatures in degrees C are from satellite digital retrievals, ships, XBTs (Expendable Bathythermographs) and buoys. There are four line types (solid, dashes, dot dashed, or dash dash dot) indicating the age of the thermal fronts. Fish tend to congregate along the boundaries where warm water meets cooler water since nutrients are found there. Thus, the Shelf/Slope interface, the edges of eddies, and fingers of warm water along the north wall of the Gulf Stream are likely productive fishing areas.

Chart 2, a South Panel (SP) Ocean Features Analysis derived from infrared satellite data, is produced on Tuesdays and Thursdays. This chart covers the area from the Gulf of Mexico, up the East Coast to Cape Hatteras, and out to 62°W. The chart shows the Loop Current and warm eddies in the Gulf of Mexico as well as the Gulf Stream and cold eddies along the Atlantic East Coast.

Enlarged subsets of charts 1 and 2 are also produced. The North Panel Enlargement (NPE) covers the area from near Cape Hatteras and east to 64°W. It is available twice a week. The South Panel Enlargement (SPE) spans the area from the east coast of Florida and north to Cape Hatteras and then east to 70°W. It is available once a week. These 2 charts are numbers 3 and 4, respectively.

Charts 5 to 7 are computer

Three charts are transmitted each day on radiofax, according to the following schedule. The chart numbers are shown in parentheses.

Time (UTC)	Day of the Week						
	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
1006	canyon (10)	NPE (3)	SPE (4)	NPE (3)	CHB (8)	F (9)	broad (11)
1016	broad (11)	broad (11)	SST1 (5)	SST2 (6)	SST3 (7)	canyon (10)	canyon 10)
1946	NP (1)	SP (2)	NP (1)	SP (2)	NP (1)	NP (1)	NP (1)

The frequencies are 12750 kHz (day) and 6340.5 kHz (night). To convert from UTC to EDT, subtract 4 hours.

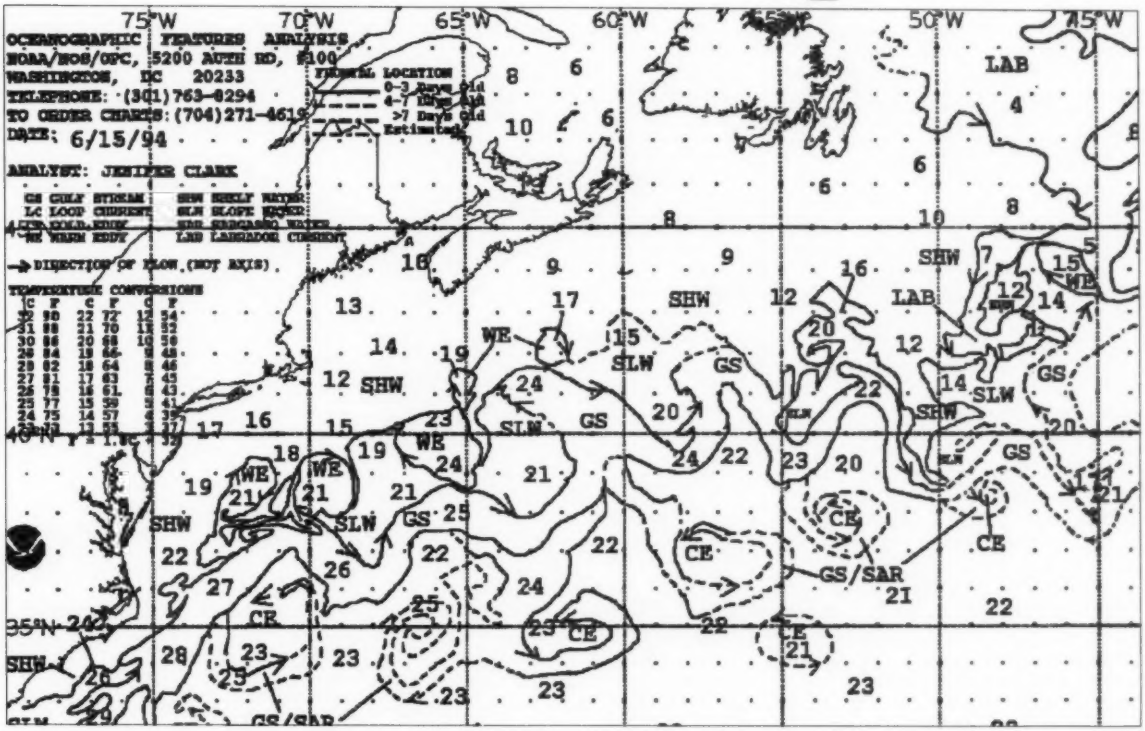


Chart 1 is called the North Panel Ocean Features Analysis. It is produced three times per week and covers the area from the East Coast near Cape Hatteras and east to 45°W. It shows the location of the Gulf Stream, clockwise circulating Cold Eddies and counter-clockwise circulating Warm Eddies and continental Slope Water. It is also available as an enlarged subset covering an area from Cape Hatteras east to 64°W. This subset is available twice per week.

generated Sea Surface Temperature (SST) analyses (SST1, SST2 and SST3, respectively) at resolutions of 14 kilometers (almost 9 miles). These charts are derived from only satellite data, using a composite of 8 days of data. Each isotherm (line of equal SST) is indicated in degrees C. They are available once a week. Chart 5 covers the area from Cape Hatteras to Cape Cod and east to 65°W. The Atlantic area from northern Florida to Cape Hatteras and east to 67°W is depicted in Chart 6. Chart 7 includes the ocean area from Cuba and up the East Coast of Florida to 70°W.

Chart 8 is the Chesapeake Bay (CHB) surface isotherm chart that is interactively generated on a computer once a week. It is derived from one image of satellite data. The resolution is 1.5 kilometer (less than 1 mile) and covers the area in the Chesapeake Bay, Delaware Bay, Pamlico Sound and the Atlantic Ocean but to approximately 100 miles offshore.

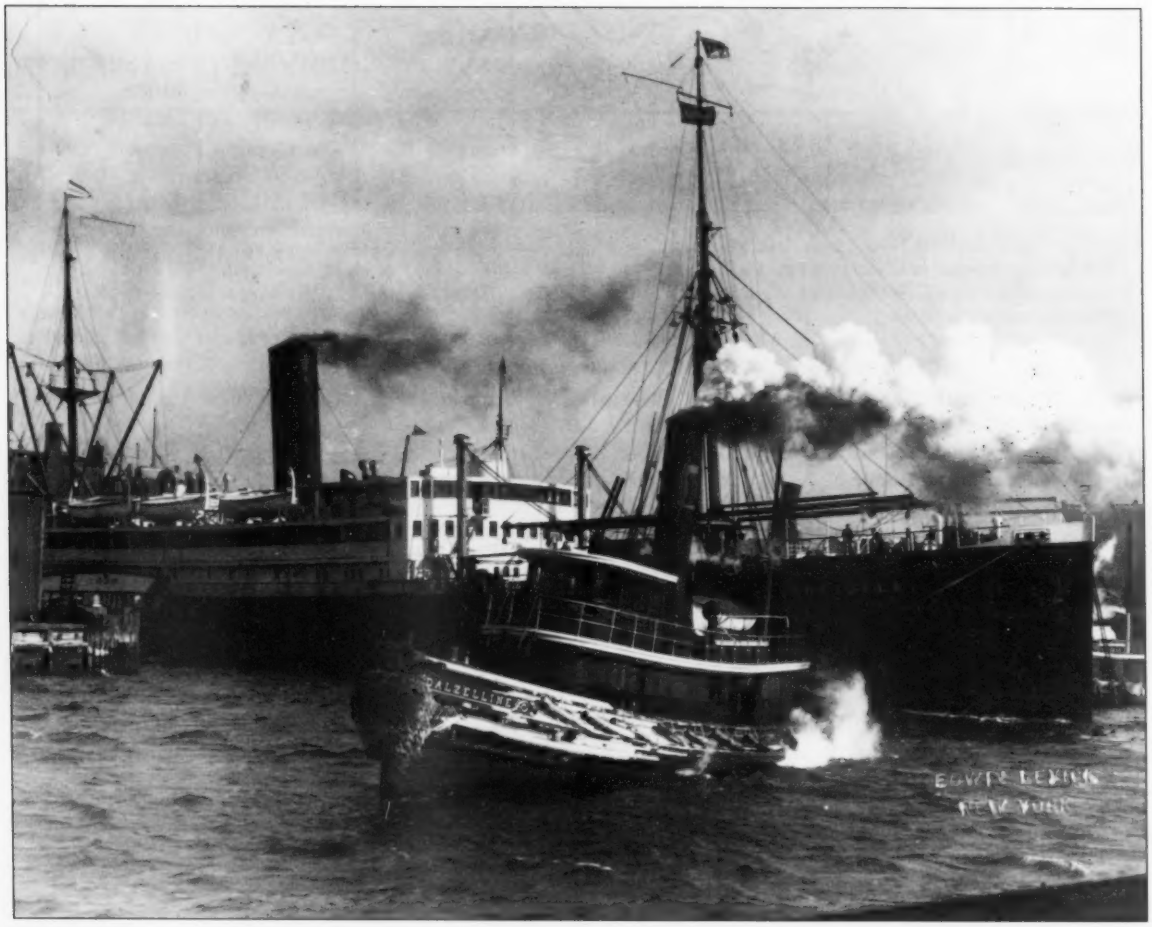
Chart 9 is the Experimental Feature Tracking (FT) chart for the Beaufort, North Carolina area. Current vectors are derived from tracking the thermal features over time. The location of the Gulf Stream is superimposed in dashed line 5 on the chart. Current vector units are knots and centimeters/second This chart is generated once a week.

Chart 10 is an enlarged North Panel Ocean Features Analysis with canyon (CANYON) locations (Norfolk, Washington, Poor Man's, Wilmington,... Corsair). The Hague line (boundary between the U.S. and Canadian waters) is indicated by a parallel slash line. This chart is produced once a week.

Chart 11 is the broad Ocean Features Analysis (BROAD) showing major ocean thermal boundaries of the Gulf Stream, Warm Eddies, Cold Eddies, and Labrador Current. It is updated twice per week.

Edwin Levick: A Man and His Time

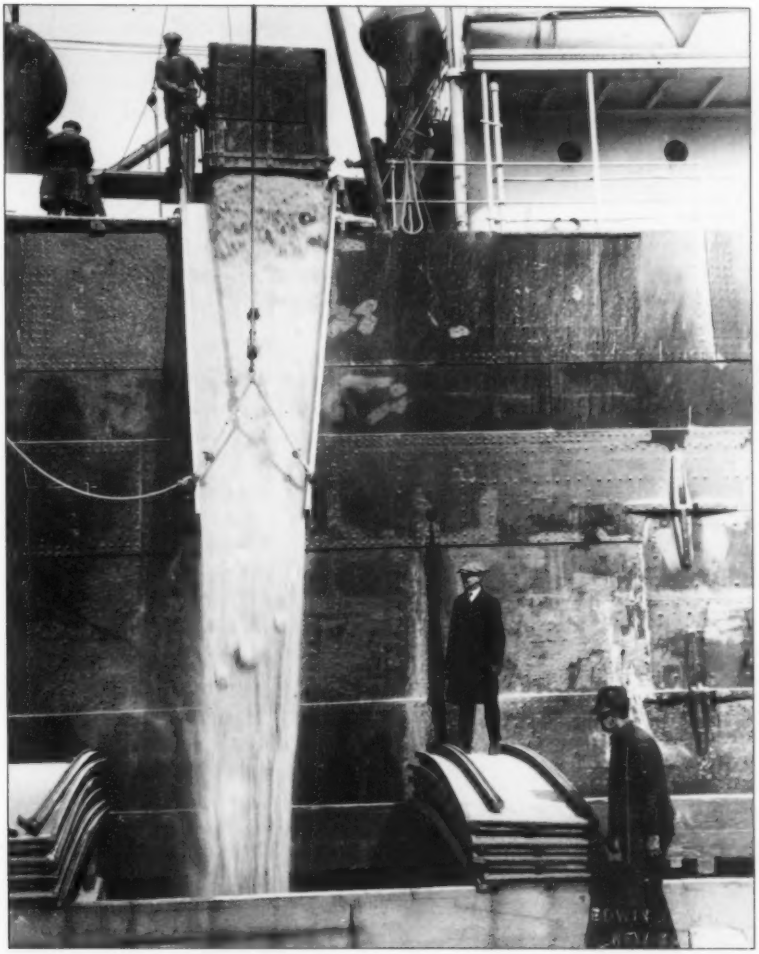
Teresa Fremaux
The Mariners' Museum
Newport News, Virginia



The S.S. **Venezuela** *departs New York Harbor in 1922 in the photograph at left. At right workmen unload sulphur from the* **Mandelta** *also in 1922. Photographs from* Edwin Levick: A Man and His Time *exhibit at the Mariners' Museum, Newport News.*

The exhibit also highlights the museum's recent efforts to preserve some of its approximately 53,000 Levick prints and negatives. Some of the Levick negatives were among the 30,000 negatives preserved and duplicated under a grant from the National Endowment for the Humanities. Several images preserved under the grant will be on display in the exhibit.

The Mariners' Museum is an educational, nonprofit institution accredited by the American Association of Museums, which preserves and interprets maritime history through an international collection of ship models, figureheads, paintings and other maritime artifacts.



Once touted as the "best known marine photographer in the nation," Edwin Levick's work for the *New York Times*, *Herald Tribune*, *Sunday World* and *Chicago Tribute* was buried for 30 years in musty New York photo stock houses. A large body of his work—37,000 original negatives and photos—was rediscovered by a collector in the 1950s and later purchased by the Mariners' Museum. Levick's reputation as an artistic chronicler of New York's maritime world in the 1900s was confirmed by the collection. Exhilarating yachting scenes in the America's Cup competitions, harbor images that captured the excitement of turn-of-the-century industrial America, the faces of immigrants and American dock workers reflect a style that is described by museum Curator Thomas Moore as "innovative and unrestrained by convention."

The exhibit also displays cameras contemporary to Levick's time which emphasize the photographer's skill in harnessing the energy of those times.

"With these cameras, you had only one chance to take the photograph that you wanted, " says Moore.

Today little is known about Levick's life and career, but his powerful portraits of American life are now preserved for future generations though the efforts of the educational, nonprofit museum. Currently, some of the approximately 53,000 Levick prints and negatives the museum owns have been saved.

Levick's works will be on exhibit at the Mariners' Museum through September 18th.

Daring Helicopter Rescues in the North Atlantic

Staff, **Sikorsky Lifeline**
Stratford, Connecticut

Gisli Hjörtur Gudjonsson

Helicopter rescues highlighted in a recent issue of *Sikorsky Lifeline* emphasize once again the importance of marine communications and the willingness of rescue pilots around the world to aid mariners in distress.

In the first rescue off the coast of Iceland, six stranded crewman were lifted from the ***Godinn,*** a salvage tug, during a violent January storm. The tug had foundered while attempting to tow an abandoned fishing vessel in high winds and heavy seas.

When two U.S. Air Force HH-60G Pave Hawk launched their helicopters from Keflavik Naval Air Station, the weather was moderate. Soon it worsened, and the 3 1/2 hour, 287-mile eastward trip to the ***Godinn*** was under ceilings as low as 30 meters (100 feet). The two helicopters encountered rain and snow showers and sometimes zero visibility.

It was anything but an easy flight: "At one point the turbulence caused an uncontrolled descent of one helicopter—from 46 meters (150 feet) to 18 meters (60 feet).

When the first aircraft arrived, only a small section of the tug's bridge was visible. The winds were at 45 knots and the seas ranged from 7 to 9 meters (25-30

feet). Hovering over the disabled vessel was complicated by protruding antennas aboard the vessel, so flight engineers helped guide the aircraft.

Crewmen were lowered to the ***Godinn*** where six survivors awaited rescue. Earlier in the day, a seventh crewman had been swept overboard and drowned. While the majority of the ***Godinn***'s crew were airlifted to a nearby shore, two needed immediate medical help. One was suffering from hypothermia and another was weak from lack of insulin. Quickly the helicopters turned toward a medical facility, a 40-minute flight away.

Despite wearing night vision goggles, the weather forced the pilots to turn back.

"We turned around and headed for the coast again, looking for a return visit," said Lt. Colonel Jim Sills, commander of the squadron. "But we couldn't get there...At times, we completely lost sight of the bird in front of us, and we were only a quarter of a mile behind them."

The pilots' only objective was to get the aircraft safely to the ground, and they headed for a nearby community that held a medical clinic, but unfortunately, no airport. Luckily, Sills found a large parking lot along the shoreline and landed safely.

Iceland's Minister for Judicial Affairs honored the two helicopter crews of the 56th Rescue Squadron in January 1994 and praised their heroism.

Deputy Commander of the Iceland Defense Force, Col John Markulis spoke of the men's work: "This was a mission of life and death for the stranded Icelanders. Our rules for flying in such severe weather were pushed to the limit by Lt. Colonel Sills and his men. We've very proud of them.

To the south off the west coast of the Republic of Ireland, a Sikorsky S-61N helicopter crewed by Captain Nick Gribble and First Officer Carmel Lyons of the Irish Department of Marine would also take part in a brave rescue of stricken mariners.

In the dark morning hours of Dec. 9, 1993, the fishing vessel ***Dunboy*** was in danger of capsizing in wind driven seas of 24 to 30 meters high (80-100 feet).

As the aircraft left the city of Shannon, the crew were winds clocked at 70 knots with gusts of 90 knots.

When they sighted the ***Dunboy,*** it was rolling more than 70° and pitching violently beam to the wind.

The crew lowered Winchman John McDermot to its bow, and the five crewmen were hoisted to safety. Suddenly a large wave caused the vessel to drop 21 meters (70 feet) and roll, snagging the winch cable which broke and catapulted back against the helicopter. The cable did immediate damage including punching a hole in the fuselage under the cockpit and severely damaging four of the five rotor blades. In its flight it hit the winch operator in the face.

Despite serious vibrations, the aircraft made a running landing at Galway airport.

The two rescues are reminders of Sikorsky helicopters' century of service in lifesaving missions around the world. From its first mission on January 3, 1944 to bring blood plasma to survivors of an explosion aboard the USS ***Turner*** off Sandy Hook, New Jersey to the present day Irish and Icelandic rescue missions, the helicopter has lived out its creator Igor Sikorsky's belief that "the helicopters highest calling is in its humanitarian mission—the ability of vertical lift to save lives."

Gisli Hjörtur Gudjonsson

Prior to the helicopter rescue of the crew of the tug, rescuers onshore waited from 6 A.M. (LST) until 3 P.M. It was difficult just waiting and not knowing if the helicopters would be able to reach the tug. The only contact they had with the sailors on the ***Godinn*** *was by way of hand signals. When the rescuers finally learned that the helicopters would make it, they signalled the crew by waving their hands in a circular motion and were able to get their meaning across. The crew labelled them "helicopter dancers."*

"Twas on the Longstone Lighthouse,
There dwelt an English maid:
Pure as the air around her,
Of danger ne'er afraid.
One morning just at daybreak,
A storm-toss'd wreck she spied;
And tho' to try seemed madness,
I'll save the crew!' she cried.
From "the Grace Darling Song"
Author Unknown

Grace Darling's Daring Deed

Elinor De Wire
Mystic Seaport Museum

Who has not heard of Grace Darling and her plucky rescue of the survivors of the wrecked steamship ***Forfarshire***? Thanks to flowery Victorian journalism and the British bent for fanfare, Grace's single and simple deed earned immortality and became as writer, Jessica Mitford, puts it, "the first media heroine."

At dawn on September 7, 1838, Grace Darling and her father, the keeper of Longstone Lighthouse off England's Northumberland Coast, awoke to the howl of wind and crashing of waves against their tower. Spume filled the air as they looked out over the North Sea where a ship was spotted aground on Big Harcar Rock, almost a mile away. A telescope revealed survivors clinging to the wreck. Twenty-two-year-old Grace, aware that her father alone could not attempt the rescue and her brothers were away from home, beseeched her father to let her go with him.

The lighthouse coble, a short, flatbottomed boat 6.6 meters (21-1/2 feet) long from stem to stern, was lowered into the wild waters. Grace and her father were able rowers, but the violent tide pushed the stout boat off course several times, making their journey to the ***Forfarshire*** twice as long. They reached the wreck in about an hour and took off five of the nine survivors, then returned to the lighthouse. Grace's father and two of the rescued seamen made a second trip to the wreck to fetch the remaining survivors. The exact number of casualties have never been confirmed. William Darling wrote of 43 drowned and 18 saved. Another biographer lists the complement as 63.

It was three days before the weather broke and allowed the survivors to be taken ashore. Their grueling ordeal was related to mainland newspapers, and on September 11 the first of the ***Forfarshire*** stories appeared in print. There was no mention of the Darlings' bravery, as arguments over the cause of the wreck and the possibility that the vessel's owners had willfully sent a disabled ship to sea eclipsed the news of the heroic rescue. When the scandal died down, a "penny-a-liner" reporter grabbed the Grace Darling story for his gossip broadside and gave it his melodramatic best. The tale caught fire and leaped from paper to paper, with each account more thrilling and courageous:

"Surely, imagination in its loftiest creations never invested the female character with such a degree

In this painting Wreck of the Forfarshire Steamer *(September 1838), Grace and her father William struggle against the raging waters of the North Sea . Nine survivors clung to the rocks near the sinking vessel, "one, Mrs. Dawson holding in her arms her two dead children." Courtesy of the Grace Darling Museum, Bamburgh, Northumberland.*

of fortitude as had been evinced by Miss Grace Horsley Darling on this occasion. Is there in the whole field of history, or of fiction even, one instance of female heroism to compare for one moment with this?"

Painters rushed to Longstone Light to capture Grace's features, then painted her into exaggerated scenes of angry seas and suffering humanity. Poets and minstrels wrote tributes to the "Grace of womanhood and Darling of mankind." Peddlers hawked phony locks of her hair and swatches of fabric supposedly from the dress she had worn during the rescue. A public conscription for the Darlings raised a gift of several hundred pounds, to which the Royal Humane Society added gold lifesaving medals and a silver tea set. Grace Darling had captured the public imagination.

Grace spent the next few years contending with the media, such as it was in the 1830s, and pursuing the elusive privacy of a celebrity. She continued to live on Longstone Light with her parents but was besieged with mail, visitors, and requests for her signature and personal effects.

A slight delicate woman, Grace's health declined and by the end of the year, she was suffering from tuberculosis. She travelled to Bamburgh to stay with her sister, Thomasin and on October 20, 1842, at the age of 26, Grace died.

It was a tragic finale to the brief bright heroism of the young woman. A huge crowd of mourners attended her burial and contributed money and labor for a memorial that rests today on her grave. Even Queen Victoria sent £20 to the fund. St. Aidans Church commissioned a stained glass window showing Grace as an intrepid symbol of salvation.

Over the years, Grace's legend grew. Her name was absorbed into everyday English as a term for feminine bravery. A museum in Bamburgh showcases Grace's life, and Longstone Lighthouse has become a memorial.

Even today, Grace Darling's image endures, because as Jessica Mitford writes, she been re-invented so many times.

The Grace Darling Museum in Bamburgh contains biographies of the heroine, facsimiles of William Darling's journal and several romanticized paintings of the rescue. Personal relics include Grace Darling's shawls, books, letters and awards. Relics recovered from the Forfarshire can also be seen as well as the the coble (boat) used for the rescue . The museum is open from the 1st of April until mid October. For more information write Mr. D. W. N. Calderwood, Honorary Curator, 109 Main St., Seahouses, NE68 7TS, England.

An Old Timer Looks Back

Jim Nelson
PMO, Houston

I've seen a remarkable change in the collection and dissemination of weather over the past 40 years. From CW broadcasts and 60 word per minute teletypes to high speed computer communications is similar to going from the bi-plane to the Concorde.

After joining the U.S. Navy in 1954, I studied at Aerographers school in Lakehurst, New Jersey. My first ship was of WWII vintage, and the communications equipment used for copying weather consisted of two model 17 teletypes and a fax machine whose sheets had to be changed for each map. We had one RBA low frequency (10 kHz–1600 kHz) radio, one RBB mid frequency (1600 kHz–4000 kHz) radio and 2 RBC high frequency (4 mHz–29.99 mHz) radio.

There were a limited number of weather broadcasts to copy in North America. The most popular synoptic broadcasts were Andrews AFB in the east and FWC Alameda in the west. They started early and had good map coverage for plotting. Also available were the New York to Paris, France via Santa Maria, Azores WMO broadcast, which, when working, provided the most ship reports in the Western North Atlantic.

When we weren't plotting maps, we were copying hourly observations. Norfolk Virginia (NAM) and Miami Florida (WBR) sent out the hourly Western North Atlantic observations. In the Atlantic, we copied New York and Paris. About 30% of our weather in Europe was intercepted by CW broadcast, which meant you arranged for a radio operator or you learned to copy it yourself.

In Europe the only Fax broadcasts were Bracknell, Offenbach, FWC Port Lyautey, Morocco and Sidi Slamane AFB, Morocco. For teletype coverage only Paris (HXX) and Bracknell (GFA) were available until the early 1960s when a number of other broadcasts came on line including Alma Ata, USSR and Wein, Austria for hourly observations. By this time, equipment had improved enough to be able to copy 100 WPM radioteletype broadcasts and 120 RPM fax broadcasts. In order to be able to supply the weather for our mission, we usually had three teletypes and one fax machine going at all times, two teletypes for synoptic and upper air data and one for hourly weather for air operations. The slow moving CW broadcast thankfully became a thing of the past.

In between Atlantic tours, I travelled north of the Arctic Circle and south of the Antarctic Circle, within 1 year. Weather communications were poor to fair most of the time. The Northern and Southern Lights made our ability to copy any broadcast a challenge. In the northern latitudes we copied New York (WSY) when we could and any fax broadcast, usually Halifax. We headed south and after passing through the Panama Canal, the only radioteletype broadcasts available were Papeete, Tahiti; Wellington, New Zealand; and Canberra, Australia. The only radio facsimile broadcasts I can remember copying were Wellington, New Zealand and McMurdo, Antarctica. These were 60 RPM broadcasts; we plotted and analyzed surface and upper air data.

During the sixties, communications improved dramatically. Most radioteletype broadcasts went to 100 WPM and facsimile increased from 60 to 120 rpm throughout most of the meteorological community. Transmission of data started to become commonplace with the advent of computer communications. This door opened when I was stationed at Norfolk, Virginia at the Fleet Weather Facility. I was assigned to the computer room where we made weather maps (similar to those on the current Navy fax broadcasts). The necessary data was transferred via telephone. We used a 2400 baud modem which was later upgraded to 4800 and then to 9600 baud. These modem boxes were quite large in the beginning, about the size of a modern Hewlett Packard Laser Jet 4MP printer. By the time I retired from the Navy, a dedicated computer system was being installed. No more fax or teletypes.

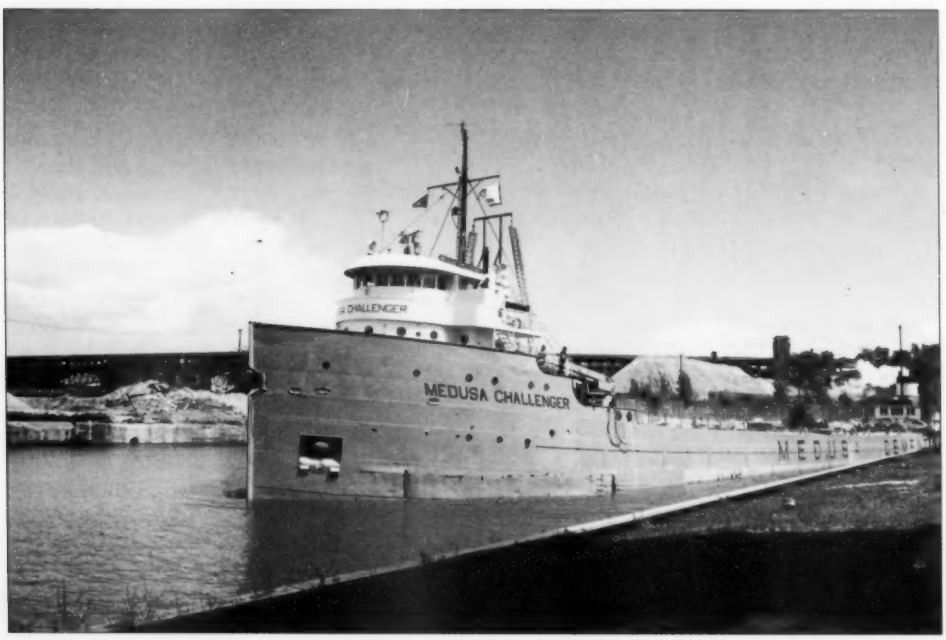
I've seen a lot of changes in my career, and most of them seem to be for the better. In today's weather office, things move faster and mountains of teletype paper no longer clutter the office–and that is a blessing in itself. Most importantly, the mariners get the help they need maybe not yet as fast as the Concorde but we're working on it.

Awards

Above, Jack Warrelmann (left), New Orleans PMO presents an outstanding observing award to the ***Sealand Costa Rica****. Accepting is Captain Steen Gramm. Another outstanding vessel in the New Orleans program was the* ***Acadia Forest****. Accepting the 1993 award on their behalf are (left to right) Radio Office Sonny F. Lanuza, Captain Peter J. Richardson and Chief Officer Arne N. Andersen. Bob Collins former Chicago PMO, presented VOS awards to both the* ***Burns Harbor*** *and the* ***Stewart J. Cort****. These two ships played a significant role in the Upper Great Lakes Marine Program, by providing 1,300 weather observations each during the shipping season. And they have maintained that pace for the past 3 years. Below, Bob Collins (right) also presented a corporate award to the Bethlehem Steel Corporation, Burns Harbor Plant. Accepting these awards are (left to right) Joe Emig, General Manager, Captain Ed Coppens of the* ***Stewart J. Cort*** *and Captain Phil Fitch of the* ***Burns Harbor****.*

Another outstanding award for observations on the Great Lakes is presented to the ***Medusa Challenger****. Presenting the award are Cleveland PMO George Smith (center) and marine forecaster Diane Moravek of Cleveland's Great Lakes Marine Unit. Accepting are the officers (from left to right) Second Mate Harry Tressa, Captain George Herdina and First Mate Bill Boyd (far right). The vessel was the top observation producer for May of 1994.*

Below, is a shot of the Medusa Challenger rounding one of the many bends in the Cuyahoga River and approaching the cement dock for unloading. This venerable old lady of the Great Lakes was built in 1906 by the Great Lakes Engineering Works in Ecorse, Michigan. It was first named the ***William P. Snyder****. It was renamed the* ***Elton Hoyt II*** *in 1926, the* ***Alex D. Chisolm*** *in 1952 and then in 1966 the* ***Medusa Challenger****.*



The New Code and Other News

Martin S. Baron
National Weather Service

The World Meteorological Organization has made several changes to the Ships Synoptic Code, which will be effective November 2, 1994.

These changes are summarized below. The National Weather Service is printing new Weather Report For Immediate transmission forms (B-80), new Ships Weather Observations forms (B-81), and a new code card with information on the changes. Port Meteorological Officers should have the updated materials for distribution by late August, 1994.

(1) **A New Group $8S_wT_bT_bT_b$** for reporting wet bulb temperature (in degrees and tenths)—will be located after the ice accretion group $6I_sE_sE_sR_s$. **Wet-bulb temperature will be included with every weather message**.

(Wet-bulb temperature was formerly recorded (not transmitted) in a shaded column of form B-81 immediately following the dry-bulb temperature TTT. This shaded area will be removed from the new forms now being printed).

(2) **New indicator S_w** – sign and type of wet bulb temperature.

0	positive or zero measured
1	negative measured
2	iced bulb measured
3–4	not used
5	positive or zero computed
6	negative computed
7	iced bulb computed

(3) New indicator S_a—sign and type of sea surface temperature, replaces S_n before $T_wT_wT_w$.

0	positive or zero intake measurement
1	negative intake measurement
2	positive or zero bucket measurement
3	negative bucket measurement
4	positive or zero hull contact sensor
5	negative hull contact sensor
6	positive or zero neither intake, bucket or hull
7	negative neither intake, bucket, or hull

(S_n remains the indicator for dry bulb temperature TTT and dew point temperature $T_dT_dT_d$).

(4) Indicator i_x – weather data indicator, to be coded as 1 or 3, rather than as 1 or 2.

1	present and past weather data included in report

3 omitted, no observation or data not available (rarely used– routinely code i_x as 1)

(5) Groups $7wwW_1W_2$ and $8N_hC_LC_MC_H$ should be considered mandatory groups. Code as 7//// 8//// when weather or clouds not observed or not determined, 70000 80000 for clear sky, no clouds, no significant weather.

Improving your level of support

The oceans cover nearly three–fourths of the earth's surface, and ships are the only source of data from most of these vast areas. Without observations from moving ships, it would not be possible to prepare marine weather charts, analyses, and forecasts. In fact, the science of meteorology could not operate without real time observations, from both land and marine areas. As weather observers/reporters, there are three critical support areas you should strive to improve at all times: (1) data accuracy, (2) report timeliness, and (3) balanced report geographical distribution.

(1) Data Accuracy – Whether measured with an instrument, or observed/estimated by eye, great care must be taken at all times to ensure the accuracy of your data. Make sure your equipment is properly calibrated. Sea-water thermometers (whether hull-mounted or located in the condenser intake) should be calibrated annually and checked every time your vessel is in the yard for service. If your vessel has an anemometer, it should be calibrated once every 6 months. Make sure the anemometer is located where the ships superstructure will not interfere with the air motion. A PMO should calibrate your barometer and barograph once every 3 months and also check your psychrometer during every ship visit. When recording dry and wet bulb temperatures, always take your psychrometer to the windward side of the ship (this is the big advantage of the portable sling psychrometer – it can be carried to the proper exposure site).
When using the sea–state and Beaufort Scale to estimate wind speed, there are five influences to keep in mind at all times, (1) heavy rain and floating ice will damp down the sea-surface, and can result in an underestimate of wind speed, (2) there is a lag period between the wind speed increasing or decreasing and changes in the sea-disturbance, (3) wind blowing against a strong current or tide will cause a greater sea–disturbance than normal and may result in an overestimate of wind speed, (4) wind blowing in the same direction as a strong current or tide will cause a smaller sea-disturbance than normal and could result in an underestimate of wind speed, (5) swell may cause more whitecaps to form, because sea-waves have a greater tendency to break when superimposed on the crests of swell. When any of these factors are present, you may need to make an adjustment to your wind speed estimates. The best wind speed estimates are made by keeping a close, continuous watch on the sea at all times. This allows you to correctly discern the situation at hand.

(2) Report Timeliness – Ship weather reports are used as real-time data (data indicative of current, existing weather condition at your vessel), so must be transmitted without delay. Make your observation as close to the reporting hour as you can, then immediately code and transmit. Please avoid any waits or holdups. Any transmission problems or difficulties with radio stations should be reported to your PMO. Write these down in the appropriate space on the back of the B-81 Ships Weather Observations form. Night-time reports tend to arrive later than daytime reports. Southern Hemisphere reports also have later arrival times.

(3) Balanced Report Geographical Distribution – Reports are not available in equal numbers from all areas. There is a chronic shortage of data from coastal waters out 200 miles (for this reason, 3-hourly reports are requested from U.S. and Canadian waters out 200 miles from shore). There is a widespread shortage of data from the Southern Hemisphere and from the Arctic Ocean. More data is also needed from the tropics and easterly trade wind belt (5–35°N), especially during the N. Hemisphere hurricane season (May–November). From the North Atlantic and North Pacific oceans, more data is needed at 0600 and 1200 UTC (these are late night and early morning times). Data is most readily available from areas specified as main shipping routes in both hemispheres. If you operate from a data short area, please make every effort to participate in the VOS program as a regular weather reporter. Your reports from these areas will be greatly appreciated.

Amy Broniarczyk

First Woman U. S. PMO

We are pleased to announce Amy Broniarczyk is the new PMO for the Chicago, Illinois area replacing Bob Collins, who is now the Data Acquisition Program Manager for Romeoville.

Amy earned a B.S. in Metorology from Northern Illinois University in DeKalb. While still in college, she served as an intern to the Weather Service office in Chicago. After graduating she worked in both the Peoria and Rockford weather offices before beginning her new job as PMO in July. Her husband James is a computer consultant.

Amy admits that she's "thrilled" at being the first female PMO in its history. She laughed when she described her first ship boarding experience: "I did it with an audience."

"They were waiting for me to get up the rope stairs and I was having a hard time. I could hear them laughing at me. I'd worn flats and I was carrying something. Meanwhile, the former PMO jumped up the stairs–he didn't even use the handles.

It was a lot of fun. When I made it up, the captain and crew couldn't have been nicer."

New Recruits

April—June, 1994

During the 3-month period ending June 30, 1994, PMOs recruited 75 vessels as weather observers/reporters in the National Weather Service (NWS) Voluntary Observing Ship (VOS) Program. Thank you for joining the program.

The basic weather reporting schedule for Voluntary Observing ships worldwide is four times daily – at 0000, 0600, 1200, and 1800 ZULU or UTC time. These are the "main synoptic" times when numerical weather prediction models are initialized with data. The United States and Canada also have an important 3-hourly weather reporting schedule from coastal waters out 200 miles from shore, and from anywhere on the Great Lakes. The coastal zones mark the transition from land to marine weather, and can have very changeable conditions, including unique diurnal weather fluctuations. Whenever possible, please transmit weather reports from United States and Canadian coastal waters at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 ZULU or UTC.

The two main methods of transmitting ship weather reports are (1) through INMARSAT Coast Earth Stations, using either INMARSAT A or INMARSAT C terminals (see John McDonald's column in this issue for more information about transmitting weather reports using INMARSAT), (2) through U.S. Coast Guard shore radio stations using Simplex Teletype Over Radio (SITOR) or plain language (recite the coded message using radiotelephone). The Coast Guard discontinued medium frequency Morse Code (CW) operations July 31, 1993. A third method, through commercially operated shore radio stations (using SITOR or CW), is available as a back-up. Please contact any PMO or see NWS Observing Handbook No. 1, Chapter 4, "Transmitting The Observation To The National Weather Service" for more details. PMO addresses and phone numbers are listed at the back of this publication.

NWS VOS SHIP PROGRAM NEW RECRUITS FROM APR 1 — JUN 30, 1994

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
AL WATTAYAH	9KKJP	KERR STEAMSHIP CO., INC.	
ALASKA	P3YK3	NORTON LILLY INTERNATIONAL INC.	NORFOLK, VA
ALVA MAERSK	9VBQ	MAERSK INC	SEATTLE, WA
ANNE SIF	OZAQ4	KNUD I LARSEN ENRUM	NEW ORLEANS, LA
ATLANTIC CRUSADER	P3ML4	INCHCAPE SHIPPING LTD	MIAMI, FL
ATLANTIC STAR	3EIK8	TECHMARINE LINES	BALTIMORE, MD
BAUCHI	LAWJ2	TORVALD KLAVENESS & C0. A.S.	MIAMI, FL
BERGEN BAY	LACM4	G.M. RICHARDS ENTERPRISES	HOUSTON, TX
BERNARDO QUINTANA A	C6KJ5	BARBER MARINE SERVICES INC	NEW ORLEANS, LA
BUJIN	3FPW3	NYK BULKSHIP (USA) INC	JACKSONVILLE, FL
CAP PALMAS	T2CG	PENN TERMINAL	BALTIMORE, MD
CAPE TAYLOR	WZSB	APEX MARINE CORP.	NEW ORLEANS, LA
CHEMICAL RUBI	C6KE8	HOLMAN SHIPPING INC	HOUSTON, TX
CHEVRON EMPLOYEE PRIDE	C6MC5	CHEVRON SHIPPING COMPANY	BALTIMORE, MD
CLIFFORD MAERSK	OXME2	MAERSK LINE	NEWARK, NJ
CONTINENTAL ALPHA	LACJ2	TECMARINE	MIAMI, FL
CORNHUSKER STATE	KAFQ	INTEROCEAN MANAGEMENT COMPANY	NORFOLK, VA
CURRENT	3FKA2	FRITZ MARITIME AGENCIES	NEW ORLEANS, LA
DUCHESS	KRCJ	OCEAN DUCHESS INC.	NEWARK, NJ
ENIF	9VVI	ENIF SHIPPING, %REEDEREI	HOUSTON, TX
EVER GOLDEN	BKHL	EVERGREEN AMERICA CORP/SUITE 2552	BALTIMORE, MD
EVER RIGHT	3FML3	EVERGREEN MARINE CORP.	LOS ANGELES, CA
EVER ROUND	3FQN3	EVERGREEN MARINE CORP.	LOS ANGELES, CA
EVER ROYAL	3FGI3	EVERGREEN MARINE CORP.	LOS ANGELES, CA
EXPLORER LT	P3PU5	BLUE FLAG NAVIGATION LTD.	NEWARK, NJ
FEYZA	TCFJ	DENAK DEPOCULUK VE NAKLIYECILIK	NEWARK, NJ
FIDELIO	WQVY	INTERNATIONAL MARINE CARRIERS, INC.	JACKSONVILLE, FL
FORUM PRINCE	P3KI3	BAYLOR AND ASSOCIATES	NEWARK, NJ
GOLDEN BLISS	ELPN	FRITZ MARITIME AGENCY	NEW ORLEANS, LA
HANJIN BARCELONA	3EXX9	HANJIN SHIPPING COMPANY	LOS ANGELES, CA
HAVJO	LALA2	A/S HAUTOR MANAGEMENT	MIAMI, FL
HEIJIN	3EUE7	NYK BULKSHIP (USA) INC.	JACKSONVILLE, FL
HOOD ISLAND	C6LU4	ECUADORIAN LINE	NEWARK, NJ
HYUNDAI EMPERIOR	3FAF3	HYUNDAI MERCHANT MARINE INC.	LOS ANGELES, CA
JEREMIAH O'BRIEN	KXCH		SAN FRANCISCO, CA
JO CLIPPER	PJNF	J. E. ASPEN SHIPPING COMPANY	BALTIMORE, MD
LADY MARYLAND	WTV4008	LIVING CLASSROOM FOUNDATION	BALTIMORE, MD
LIMAR	ELQL7	OMI BULK MANAGEMENT CO.	NEWARK, NJ
LUCKY	XYKT	LASCO SHIPPING CO	SEATTLE, WA
MANGAL DESAI	VTJS	LARSEN & TOUBRO LTD., BAKHTAWAR,	CLEVELAND, OH
MELVIN H. BAKER II	C6BT8	T. PARKER HOST	BALTIMORE, MD
MILITOBI	WSZJ	NATIONAL WEATHER SERVICE OFC	SEATTLE, WA
MISSION CAPISTRANO	KRCE	MARINE TRANSPORT LINES	SEATTLE, WA
MONARCH OF THE SEAS	LAMU4	ROYAL CARIBBEAN CRUISES LTD	MIAMI, FL
NAVIX ERICA	3ELU9	UNIVAN SHIP MANAGEMENT, LTD	MIAMI, FL
NEVA	H9ZW	WORLD WIDE MARINE	NEWARK, NJ
NEW CARISSA	DVUI	TAIHEIYO KAIUN K.K., RM. 316, MARUNOUCHI BLDG.	SEATTLE, WA
NORDIC EMPRESS	ELJV7	ROYAL CARIBBEAN CRUISES LTD	MIAMI, FL
NORDIC PRINCE	LAPJ3	ROYAL CARIBBEAN CRUISES LTD	MIAMI, FL
NORTHERN LIGHT	ELAZ4	MARITIME OVERSEAS COMPANY	NEW ORLEANS, LA
OLIVEBANK	3ETQ5	GULF AND ATLANTIC MARITIME SERVICE, INC	BALTIMORE, MD
OVERSEAS ALASKA	WEHV	MARITIME OVERSEAS CORP.	SEATTLE, WA
PADRONE	C6BK6	GULF AND ATLANTIC MARITIME SERVICES	NEWARK, NJ
PATRICIA	ELNB6		MIAMI, FL
PEARL ACE	VRUN4	STRACHAN SHIPPING CO.	JACKSONVILLE, FL
PETROBULK PROGRESS	C6JK6	TRANSOCEAN SHIP MGMT (PTE) LTD	JACKSONVILLE, FL
PETROBULK RACER	ELKZ4	NAESS SHIPPING (HOLLAND) B.V.	MIAMI, FL
REGINA J	V2AC3	GLOBE SHIP MGMNT INC	MIAMI, FL
SALOME	S6CL	WALLENIUS LINES NORTH AMERICA, INC.	NEWARK, NJ
SEALAND GUATEMALE	OUJV2	BRANDTSHIP USA,INC.	NEW ORLEANS, LA
SEVEN OCEAN	DULR	K LINE AMERICA INC	SEATTLE, WA
SKAUTROLL	LAMP4	S&C MARINE A/S	MIAMI, FL
SOARER CUPID	3EPM4	FRITZ MARITIME AGENCY	NEW ORLEANS, LA
SONG OF AMERICA	LENA3	ROYAL CARIBBEAN CRUISES LTD	MIAMI, FL
SONG OF NORWAY	LNVP3	ROYAL CARIBBEAN CRUISES LTD	MIAMI, FL
SOVEREIGN_OF THE SEAS	LAEB2	ROYAL CARIBBEAN CRUISES LTD	MIAMI, FL
SUN VIKING	LIZA3	ROYAL CARIBBEAN CRUISES LTD	MIAMI, FL
SUNMAR STAR	WBE8415	SUNMAR NAVIGATION INC.	SEATTLE, WA
URANUS	ELIE7	MARITIME OVERSEAS CORP	MIAMI, FL
USCGC RESOLUTE WMEC 620	NRLT	COMMANDING OFFICER	SAN FRANCISCO, CA
USCGC VALIANT (WMEC 621)	NVAI	COMMANDING OFFICER	MIAMI, FL
USNS TENACIOUS	NTRG	USNS TENACIOUS	SEATTLE, WA
USNS YUKON (T-AO 202)	NYUK	USNS YUKON (T-AO 202)	NEW ORLEANS, LA
VIKING SERENADE	C6CP	ROYAL CARIBBEAN CRUISES LTD	MIAMI, FL
YOHFU	3EPK5	NYK LINE NORTH AMERICA INC	SEATTLE, WA

All times unless noted are UTC (universal time) and all miles are nautical. For additional detail, tropical cyclones will be covered in the annual reports from the tropical cyclone centers around the world. The weather summaries are based upon the track charts and Northern Hemisphere Surface Charts as well as ship reports, and attempt to highlight the most significant ocean features each month. The track charts are provided by NOAA's National Meteorological Center. If an extratropical storm is particularly bad for shipping, we may designate it as the Monster of the Month. The Gale Tables provided by the National Climatic Data Center at Asheville, NC, have been expanded to include U.S. ships reporting winds of 34 knots or more.

North Atlantic Weather January, February, March 1994

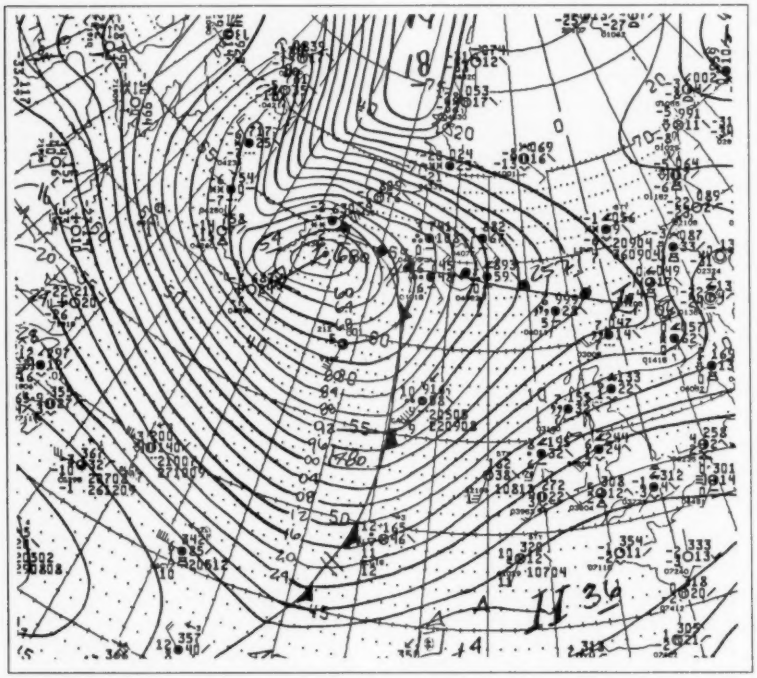
January—The significant feature on the climatic chart for January was a large Azores–Bermuda High reminiscent of summer. The normally potent Icelandic Low was also deeper than normal. In fact, pressure anomalies of –12 millibars were analyzed from Iceland to Norway. When these two climatic features are more intense than normal this spells trouble for mariners traveling the North Atlantic shipping lanes. The 500–millibar chart indicated the steering patterns were slightly north of zonal, so that a storm moving off Nova Scotia in an ideal situation would cross Ireland.

The month opened with a wicked 960–millibar storm that intensified during the early hours of the new year off Newfoundland. At 0600 the C6I75 (44.1°N, 43.0°W) celebrated the new year with 50–knot westerlies in 10–meter swells. At 1200 the CGIK8 (47.9°N, 33.8°W) ran into 10.6 meter seas in 55–knot (storm) west southwesterlies. The storm moved east northeastward and began to fill. However, it was not quite through. On the 5th, moving southeastward, it reintensififed and moved through the Irish Sea as a 969–millibar Low. This was the beginning of a week of horrendous weather over the North Atlantic.

A 965–millibar Low, which had developed in the Gulf of Maine on the 4th, moved off Newfoundland 2 days later. It turned eastward and was a potent force from the 6th through the 8th. Throughout the 6th, the ***Sir William Alexander*** in the entrance to the St. Lawrence River was reporting 60–to 65–knot winds. At 1800 the ***Newfoundland Otter*** (49.6°N, 53.0°W) reported a 50–knot southwesterly, and at 1200 on the 7th the ***Atlantic Compass***, some 400 miles southeast of the storm center, hit 44–knot winds in 7.0–meter swells. On the 8th, the system began to fill and was absorbed by another Low.

This new system deepened very rapidly as it approached Ireland from the southwest. Its central pressure dropped from an estimated 986 millibars on the 8th at 1200 to 956 millibars some 24 hours later. This would qualify as a "bomb." Ships in the vicinity were reporting strong gale to storm force winds and seas up to 9.1 meters. The ***Madison Maersk*** just northwest of the center ran into 5.1–meter seas in 40–knot winds with a 968–millibar pressure at 1200 on the 9th. Six hours later winds were measured at 55 knots with seas up to 7.0 meters. The circulation of the storm actually curved most of the northern North Atlantic and encompassed several centers on the 10th and 11th. By 1200 on the 11th, a 958–millibar center was analyzed near 60°N, 27°W where it was in the process of turning a counterclockwise loop. Gales were being generated out to 600 miles to the south as the system finally began to weaken and head eastward on the 13th.

While there were several good storms during the second half of the month. The highs dominated and kept cyclonic activity pretty far to the north. For example, on the 18th a storm which had moved off Labrador 2 days before intensified to 948 millibars in the Denmark Strait. The ***Cumulus*** (57°N, 22°W) kept a good weather eye on this Low on the 18th. This British Ocean weather station while about 600 miles southeast of the center reported winds that ranged from 40 to 48 knots in 4.9 to 7.9–meter swells. The storm wound down on the 19th and a 965–millibar Low showed up near Kap Farvel and slowly crept up to the east coast of Greenland during the next several days. Another system in the Denmark Strait on the 20th was at 957 millibars. It headed east northeastward and deepened to 942 millibars by 0000 on the 22nd. For



At 0000 UTC on the 18th of January the NWS Northern Hemisphere surface analysis showed the potent 954-millibar storm lurking near the Denmark Strait.

vessels that had to venture north of 55°N, it was brutal. The ***Cumulus***, of course, had to be near 57°N and they reported storm force winds in 25-foot swells on the 21st. The ***Komandarm Shcherbakov*** (61.5°N, 4.1°W) at 0600 on the 22nd ran into 54-knot winds in 7.9-meter seas while the LF3F (64.3°N, 7.8°E) hit 58-knot southwesterlies in 6.0-meter seas. The ***Cumulus*** farther south encountered strong gales but was now on the backside of the Lows so that temperatures dropped to near freezing in 9.1-meter swells, superstructure icing becoming a potentially deadly problem in this situation. The Low split into several centers on the 23rd and remained potent. Finally on the 24th, some relief arrived as the system weakened rapidly.

Several other Lows flared up briefly during the final week of January. On the 26th, a 967-millibar Low was analyzed near 60°N, 32°W while 3 days later a 964-millibar center reared its ugly head just south of Iceland. On the 27th, a 960-millibar Low as spotted in the Norwegian Sea.

Casualties—A 20-year old Greek freighter sank off Newfoundland on the 1st in storm seas. Its 36-member crew of Greeks and Filipinos is missing and all are presumed drowned. A massive 5-day search involving vessels and aircraft from eight countries was launched. A Canadian search aircraft spotted a life raft some 600 miles northwest of the Azores but the Norwegian tanker ***Thorsaga*** also found a second empty life raft which was overturned. A Navtex message broadcast at the time of the sinking reads as follows: "All ships in the vicinity of 46° 53'N, 33° 10'W requested to proceed and render all possible assistance to distressed vessel MN ***Marika 7***. Vessel sunk and survival craft are in the water. Request vessels proceeding advise RCC Halifax their position and ETA at distressed vessel's position."

A 150.8-meter ocean going barge loaded with 27,000 tons of phosphate rock sank in the Gulf of Mexico about 10 miles outside the Mississippi's River's South Pass in rough weather on the 17th. On the 15th, the refrigerated mv ***Merchant*** returned to Bermuda after developing a 10 degree list when cargo shifted in heavy weather. The mv ***Tina*** developed a heavy list during gales and sank near Buoys 28 and 30 in the River Ems near Eemshaven, Germany on the 28th. The crew escaped. Also the 28th, the North Sea rig ***Polyconcord*** broke its moorings and hit a bridge in Bergen, Norway. The port of Hamburg, Germany experienced its second highest floodwaters ever on the 27th as storms drove North Seas waters up the River Elbe.

The week long storms that blasted England and western Europe during the second week in January were responsible for severe flooding and mudslides that destroyed homes and property and were responsible for a number of deaths in France, Spain, and Germany. In England alone, flooding damage was estimated at more than $74 million.

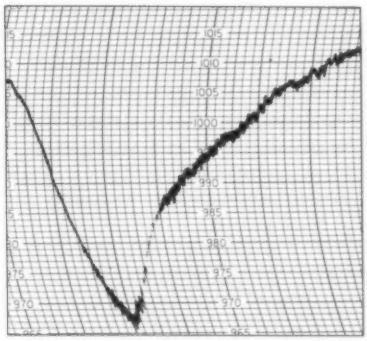
February—A deep Icelandic Low highlighted the climatic pressure chart this month. It was deep enough to create negative anomalies down to 12 millibars near 50°N, 25°W. The center of this deep low was placed farther south

than normal as well accounting for part of the anomaly. The upper air pattern reflected this surface feature with a deep trough which resulted in a near northerly flow east of 30°W and north of 45°N.

During the first half of the month, the most intense cyclonic activity was concentrated in the Denmark Strait about 600 miles southwest of Iceland. The month began with a wicked 956-millibar Low in the southern entrance to the Denmark Strait with a circulation that extended to 45°S. At 1200, the LFSR (66.9°N, 10.9°E) reported 48-knot westerlies in 7.0-meter seas. To the south, the ***Professor Szafer*** (35.0°N, 46.6°W) was nailed by 48-knot westerlies. The system remained potent until the 3rd but by that time was overshadowed by an intense storm heading toward England.

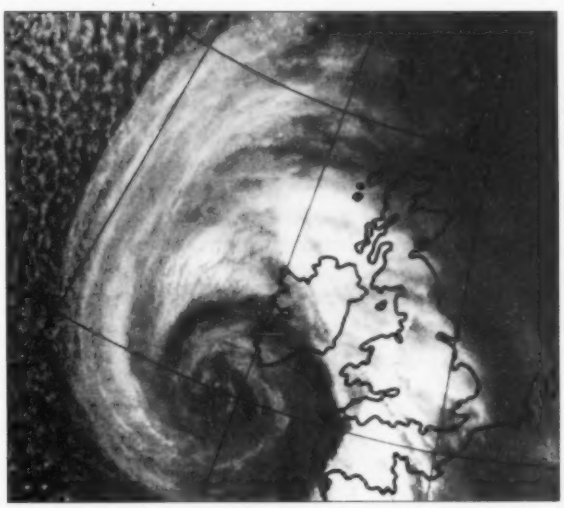
Monster of the Month— This English blockbuster actually developed on the 1st near 40°N, 45°W. by the 2nd, although relatively small, it was already generating strong gales close to its 984-millibar center. By the 3rd as it barged into Ireland, the central pressure had plummeted to 949 millibars. To the southwest some 1200 miles was a 1042-millibar High—a pressure gradient of nearly 100 millibars. Storm force wind reports abounded. At 1200, the D5YA (57.9°N, 11.9°W) measured a 52-knot southerly in 13.4-meter swells. The ***Cumulus*** (56.9°N, 20.1°W) reported storm force winds during the first part of the day. The station 63111 (59.5°N, 1.5°E) at 1500 measured 53-knot southerlies in 6.4-meter seas. As the system moved up the west coast of Ireland on the 4th, it began to weaken. Even as short-lived as it was, this storm caused some real headaches for shipping thus earning the Monster title. By the 5th, it was over Scotland and just an ordinary Low.

Another brutal storm appeared in the Denmark Strait on the 11th. Originating on the 9th near 38°N, 65°W, it slowly deepened as it moved rapidly northeastward, then north northeastward. From a 980-millibar central pressure at 1200 on the 8th, it dipped to 946 millibars 24 hours later. At 1500 on the 11th, the TFTV (62.9°N, 24.2°W) measured a 964.7 millibar pressure in 44-knot winds. The strongest winds were being reported in the Norwegian and North Seas where storm force winds and 4.5-to 7.6-meter swells were common. At 1780, the ***Rubin Emblem*** (49.1°N, 19.6°W) ran into



14.9-meter swells while the ***Cumulus*** (55.9°N, 10.1°W) reported 7.9-meter swells. While the Low began to fill on the 12th, the gradient between it and a 1050-millibar High over Finland was very tight. That High remained intense and settled in over Europe for the next week.

On the 12th, a Low formed about 300 miles east of Cape Hatteras. It moved northward then northeastward across Nova Scotia and Newfoundland slowly intensifying on the 14th and 15th. After heading eastward, it swung northward on the 16th and then stalled



Satellite Data Services Division

The Monster of the Month is shown in all its glory by NOAA 11 satellite in early February 1994. At this time it was approaching Ireland and its central pressure was approaching its 949-millibar minimum.

Above the ***Sealand Integrity*** *shows its measure of the monster's power with its barograph trace from the 2nd and 3rd near 47°N, 12°W.*

after crossing the 55th parallel near 35°W. It also deepened to 968 millibars. Most of the strong winds were being reported well to the east of the center. The storm remained potent and nearly stationary until the 19th when it headed northward and merged with another system.

During the second half of the month, there were very few extratropical cyclones but a couple of them were potent. On the 18th, a Low developed southeast of the Grand Banks and meandered northeastward on a course that involved two counterclockwise loops. From the 21st through the 22nd, its central pressure was below 970 millibars. Vessels to the south of the center were encountering gale to strong gale force winds in 12-to 20-foot seas. At 1200 on the 21st, the ***Atlantic Conveyor*** (49.2°N, 23.8°W) was battered by 52-knot westerlies in 10-meter swells. At 1800, the ***Canmar Ambassador*** (48.5°N, 230.9°W) in 6-meter swells reported 44-knot westerlies. This system began to fizzle on the 23rd but a day later, another vicious storm roared into the area to take its place. This storm formed off Norfolk, Virginia on the 21st and headed east northeastward. On the 23rd, it had a 970-millibar center near 45°N, 43°W. Twenty-four hours later central pressure had dipped to 954 millibars. At 1200 on the 24th, the GYAB (34.5°N, 30.3°W) battled 9.1-meter swells and 47-knot winds. This was typical of conditions south of the storm's center on the 24th and 25th. The following day it began to weaken.

Casualties:—Twenty-six crew members disappeared without a trace when the Maltese-registered scrap metal ship ***Christinaki*** sank in a fierce storm on the 2nd about 220 miles west southwest of Land End's, England. The storm was so powerful that rescue vessels could not make headway toward the sinking ship in Force 12 winds and 9.1- to 15-meter seas. Merchant vessels, military aircraft and a British naval survey vessel searched the area after struggling north against hurricane force winds and seas from the northwest on the 3rd and 4th. The 36,000-ton Austrian containership ***Trio 1*** fought to within 20 miles but then watched helplessly as the ***Christinaki*** disappeared from their radar screen. The crew consisted of five Greek officers and 21 Filipinos. This same storm ravaged the British and Scottish coast and disrupted maritime activities in the English Channel. No other vessels were lost, but several reported damage and French helicopters evacuated a crew member with extensive injuries from a 8,000-ton ship in the English Channel.

The 226-meter containership ***Saudi-Quassim*** broke its moorings in high winds in Port Newark, New Jersey and its stern was blown across the Elizabeth Channel crashing into a cargo crane which caused a second crane to smash into the container vessel ***Clifford Maersk*** which was tied up nearby. There were two injuries to dockworkers. In mid February, a loaded oil barge, B-130, grounded in dense fog on a hard sand bottom in western Long Island Sound but did not spill any of its 137,000 barrels of oil. It was later refloated. Late in the month, two crew members died when the ice-covered 24.3-meter fishing vessel ***Lady Lynn*** capsized in New London, Connecticut within a few yards of its dock. It was also thought to be unstable.

March—On the climatic pressure chart, the Icelandic Low was as much as 14 millibars deeper than normal while the Azores-Bermuda High was up to 8 millibars more intense. The pressure gradient was very tight across the major shipping lanes between western Europe and North America. With a trough in the upper atmosphere over eastern North America, the steering currents on average tended toward the northeast over much of the North Atlantic. The first 9 days of the two month were dominated by a fierce Low that took a track that resembled a figure 8 through the Denmark Strait before moving across to the Norwegian Sea. Actually several centers were found within this sprawling complex circulation but the Denmark Strait center remained dominant. It remained below 970 millibars from the 1st through the 9th. Gale and strong gale force winds were common from off the coast of Portugal to the Norwegian Sea and west to Greenland. On the 4th, the ***Ewl Venezuela*** (47.2°N, 12.0°W) hit 40-knot winds in 9-meter seas. The following day, the ***Dmitriy Pokramovich*** encountered 54-knot southwesterlies north of Trondheim, Norway. The ***Cumulus*** (56.9°N, 19.8°W) at 2100 on the 6th reported in with 41-knot southerlies in 4.5-meter swells. Storm force winds became more apparent on the 7th and associated with the storms cold front and enhanced by a strong 1034-millibar High dominating the southeastern North Atlantic. At 1500 on the 7th, the ***Canmar Ambassador*** (46.0°N, 39.3°W) ran into 50-knot southeasterlies in 6-meter swells. It was on the 8th that the 960-mil-

libar storm center became moving eastward, with a secondary center remaining over Iceland. Strong west to southwest winds blanket the waters from south of Iceland to the English Channel to the Norwegian Sea. The ***Pavel Kaykov*** (65.3°N, 2.4°E) measured 48-knot southwesterlies at 1200 on the 8th. By the 10th both centers had moved into the Barents Sea but were quickly replaced by another storm.

This 964-millibar Low arrived in the Denmark Strait from Hudson Bay by way of Newfoundland. It wasn't until the 10th that it really deepened. It remained south of Iceland and didn't linger as it turned northeastward toward the Norwegian Sea.

The weather was pretty messy over the North Atlantic during the middle part of the month, but it was mostly in the form of a series of moderate Lows and complex systems that are very difficult to describe much less forecast. There are periods when each new map seems to bear little resemblance to the previous one.

The next attention-getter occurred on the 21st when a 958-millibar Low crossed the 60th parallel near 30°W. It had formed the day before over the Grand Banks. By 1200 on the 22nd, it was off the west coast of Iceland, and its central pressure had plummeted to 938 millibars. Storm force winds were encountered by the ***Bjarni Saemundsson*** and ***Hofsjokull*** just east and west of the center on the 21st. At 0300 on the 22nd, the ***Malla Arctica*** (59.0°N, 39.4°W) battled 10.9-meter seas while measuring 58-knot westerlies. At 1200 these winds were up to 64 knots and seas were estimated at 15 meters. At 2100 the P30B2 (66.0°N, 19.6°W) reported a 63-knot blow in moderate intermittent snow. The TFXP (62.6°N, 8.9°W) ran into a 52-knot westerly. The storm moved across Iceland on the 23rd and began to fill as rapidly as it intensified.

A few days later, on the 28th, a Texas Low by way of Long Island hit the southern entrance to the Denmark Strait stalled and exploded. At 1200 on the 27th, central pressure was estimated at 970 millibars. Within 24 hours it was down to 958 millibars. At 1200 on the 28th in the Denmark Strait, the Y4HM was clobbered by a 58-knot easterly in 13-foot seas. Nearby, the ***Frithjof*** measured a 42-knot easterly in 16-meter seas. By 1800 the ***Fornax*** (61.1°N, 29.1°W) was measuring 72-knot south southeasterlies.

The ***Frithjof*** continued to verify the storm's potency on the 29th observing and reporting 7.6-meter seas in combination with winds out of the northeast at strong gale force. By the 30th, the center finally moved westward toward the coast of Greenland and began to weaken. But as a famous baseball player once said, "It ain't over till it's over."

One more blast occurred as March went out like a lion in the eastern North Atlantic. A freight train of a storm roared toward the Faeroe Islands developing a 946-millibar center on the last day of the month. Its associated cold front whipped across England, western Europe, and the North Sea. Rigs and vessels in the North Sea were registering 45- to 50-knot winds in 4.5 to 7.6-meter seas. On the 30th at 0900, the LFAW (60.4°N, 2.7°E) was belted by 50-knot south southeasterlies in 5.4-meter seas. Later in the day, winds were up to 54 knots and seas to 6.0 meters. Station 62114 (58.3°N, 00.1°E) at 1800 measured 48-knot southerlies in 7.9-meter seas, while nearby rig 62131 reported 11.5-meter swells—the North Sea was boiling. These miserable conditions continued through the 31st. At 0600 the ***Toisa Cougar*** (61.6°N, 01.3°E) was slammed by 6.0-meter seas, while 12 hours later station G2145 (57.0°N, 01.9°E) reported a 60-knot northerly.

Casualties—In early March, the 168-meter ***Alaska***, a freighter traveling at high speeds, slammed into the offshore supply vessel, ***Reliant Seahorse***, in dense fog at the mouth of the Mississippi River. No injuries were reported but the impact caused the smaller supply vessel to roll over on its beam with the ship's bow penetrating more than half the width of the smaller vessel. On the the 8th, a strong cold front whipped through Norfolk, Virginia causing a towed barge to heel excessively and dump its cargo of scrap steel into the harbor. The ***Dalia*** sank in high seas off the north coast of Lebanon on the 6th. The 17-member crew was rescued. On the 7th, the mv ***Falticeni***, Constanta for England, sank 21 miles east of Skyros after the engine broke down in heavy weather on the 5th. Some 20 survivors were picked up by the Norwegian mv ***Moxnes***. Four crew members were missing. The mv ***Dina*** sank 10 miles off Fastnet on the 12th after a list developed in heavy swells. Also on the 12th, the ro-ro ferry ***Kamiors***, Piraeus for Rhodes, ran aground during heavy weather. There were 24 passengers and 29 vehicles aboard but no reported injuries.

Conversion Helper										
meters	1.5	3.0	4.6	6.1	7.6	9.1	10.6	12.2	15.2	18.3
feet	5	10	15	20	25	30	35	40	50	60

North Pacific Weather
January, February, March 1994

January—A large Aleutian Low dominated the North Pacific climatic chart this month, but it was slightly less intense than normal. This is usually a good sign for mariners and there were few severe storms in this basin. Upper level flow was nearly zonal from China to about 165°W where it turned toward the northeast.

During the first half of the month, storms were mostly weak to moderate. The month opened with a potent double-centered 960-millibar Low dominating the northeastern North Pacific resulting in a number of strong gale wind reports. However, a 986-millibar double-centered Low off Japan was actually creating more problems as its gradient was enhanced by a 1028-millibar High to the east. The ***President Hoover***, for example, battled 6-meter swells in 42-knot southerlies near 47.7°N, 157.8°E at 0000 on the 1st. At 0600 the ***Luna Maersk*** (36.8°N, 154.5°E) ran into 55-knot northwesterlies in 7.9-meter swells. The system finally became a single-centered 962-millibar Low on the 2nd and was centered off Kamchatka. The following day, it began to weaken.

On the 5th, a large amorphous Low with five separate centers was analyzed over the western North Pacific. While none were particularly potent, pressure gradients were such that a number of vessels ran into gales and the C6KF2 (33.5°N, 145.4°E) hit a storm force wind. Later in the day, one of the centers near 53°N, 170°E was estimated at 965 millibars and by the 6th, it was down to 956 millibars with a nice tight circulation hugging the Kamchatka Peninsula. Ships in the vicinity experienced strong gales.

A Low from Japan intensified to 967 millibars near 45°N, 170°E on the 9th. Ships southwest of the center reported gales and swells ranged from 3.5 to 7.3 meters. The ***Golden Gate Bridge*** (40.4°N, 171.9°E) hit a 56-knot westerly while battling 7.3-meter swells. This was verified by the ***Emerald Coast*** nearby which ran into 52-knot westerlies in 6-meter swells. The Low weakened on the 10th as it slowly turned east northeastward after crossing the dateline. It remained recognizable until the 12th.

It wasn't until the 22nd that the next real weather producer showed up near 45°N, 165°E. This Low moving toward the northeast dipped to 962 millibars by 0000 on the 23rd. Vessels such as the ***NYK Seabreeze***, ETNJ3 and the ELO4 reported strong gales in 2.4- to

3.6-meter seas. The storm continued northeastward and the ***Sea-Land Voyager*** hit 50-knot northwesterlies in 6.0-meter swells near 51.0°N, 176.3°E early on the 24th. The following day the 972-millibar Low made its way across the Alaska Peninsula.

The month closed with a double bang. On the 28th, a 973-millibar Low near 45°N, 175°E began to intensify. By 0000 on the 29th, its central pressure had dipped to 966 millibars with gales and strong gales being reported south of the center. The ***Sea-Land Voyager*** (37.3°N, 175.8°E) measured a 55-knot westerly in swells that were estimated at 15 meters. This system was replaced by a second potent system on the 30th. By 1200, its central pressure was down to 964 millibars as it crossed the 45th parallel near 172°E. At 0000 the ***Skaugran*** (41.6°N, 168.3°E) reported measured 50-knot southerlies in 4.5-swells. Conditions over the northern shipping lanes remained rough into February.

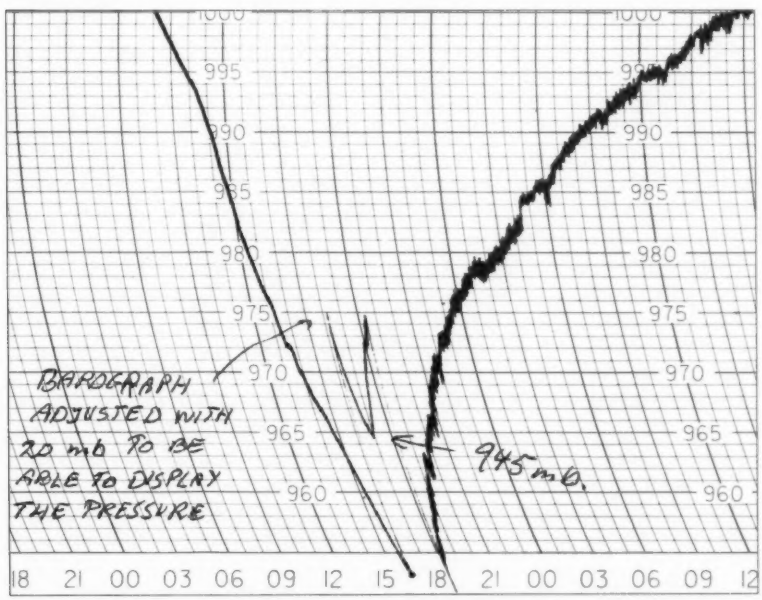
Casualties—The 272-meter tanker ***Overseas Ohio*** had its bulbous bow battered when it collided with an iceberg about 25 miles south of Valdez in rough seas on the 2nd. On the 4th the bulk carrier ***Arc*** returned to Honolulu after encountering heavy weather. The 78-member crew of the mv ***Queen Alma*** was rescued by a Philippine naval patrol craft after their vessel started sinking in heavy seas off Shibut Island on the 8th and 9th.

February— The double-centered Aleutian Low covered a good portion of the northern North Pacific on the climatic pressure charts. Its western center was displaced westward to the southern tip of the Kamchatka Peninsula resulting in anomalies down to -10 millibars. The subtropical high was farther north than normal resulting in positive anomalies up to 12 millibars near 45°N, 160°W. In the upper air, steering patterns reflected the surface Low over Kamchatka with a northwest-southeast oriented trough over the area. This resulted in some dramatic counterclockwise steering currents in the northwestern North Pacific and a general east northeastward flow elsewhere.

The month opened with a 1000-millibar Low moving off Hokkaido and intensifying as it moved along the Kurils and onto the Kamchatka Peninsula. The central pressure dipped to 960-millibars by 0000 on the 3rd. It circulation extended along the Japanese Islands where gales and strong gales were being encountered in 3.6- to 6-meter swells. At 1200 on the 2nd, the ***Primernyy*** (50.8°N, 156.8°E) measured 48-knot northerlies while battling 3.9-meter seas. On the 4th, the 968-millibar Low moved ashore as the circulation began to split into several moderate centers. One of these centers became a separate storm on the 5th near 52°N, 175.°E. It was soon a 962-millibar system recurving westward along the Aleutians. It moved close to Kamchatka on the 7th before turning northward.

On the 8th a system which had formed east of Hokkaido intensified near 43°N, 167°E. It dipped to 964 millibars at 1200 and the following day it bottomed out at 957 millibars. Winds near the center were in the strong gale force range but the ***Jade Forest*** (44.6°N, 167.8°E) and the ***European*** (50.2°N, 163.9°E) both ran into storm force winds at 0000 on the 9th. And the ELE57 (37.9°N, 163.7°E) was clobbered by 7.6-meters swells. As the system neared the Aleutians later on the 9th, it began to weaken.

On the 11th a 968-millibar storm was analyzed over the north-

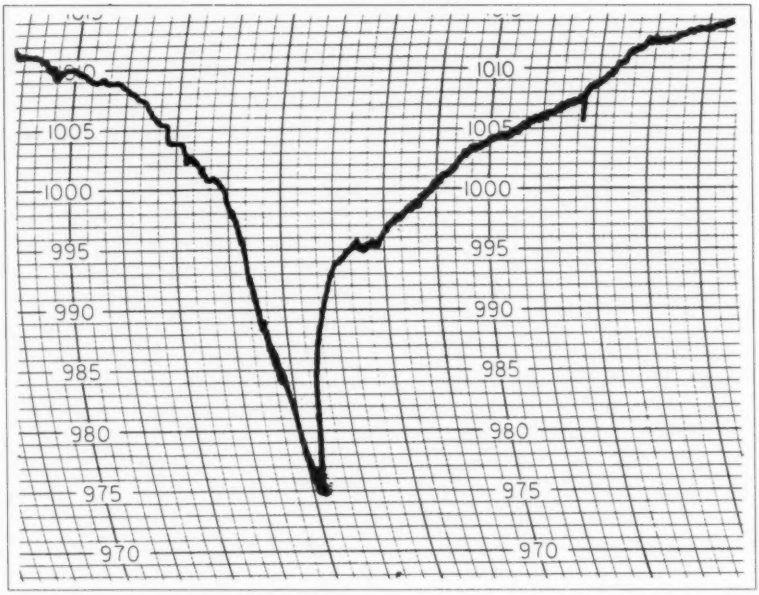


The barograph trace from the ***Maren Maersk*** *on February 22nd shows a potent storm.*

ern Kurils. Ships to the south and southwest encountered gale and strong gale force winds in 4.-5- to 9.1-meter swells, particularly in an associated trough. The storm moved northward but was quickly replaced by another system in the Kurils on the 13th. This 960-millibar Low moved into the Sea of Okhotsk where it turned a counterclockwise loop on the 14th, before resuming its northward journey. The effect of the loop was to prolong the severe weather along the major shipping routes to and from Japan. There were very few ship reports to verify the intensity of this storm. At 1200 on the 14th near 49.7°N, 153.7°E, the UOSN measured a 60-knot northerly. After the loop, the system began to weaken rapidly.

The North Pacific was relatively quiet until a 968-millibar Low barged onto the scene near 45°N, 175°E at 1200 on the 19th. Twenty-four hours later, the Low, sporting a 960-millibar center, was over the western Aleutians terrorizing traffic along the northern shipping lanes. One of the few indications was a report from the ***Sovetskaya Sibir*** (51.8°N, 154.9°E) at 0000 on the 21st when they encountered 50-knot northerlies. The storm fell apart rapidly that day. Meanwhile off Honshu a wicked but short-lived storm came to life on the 21st. While it was potent for just two days a report by the ***Maren Maersk*** indicates that it was a lot more severe than first suspected. At about 1700 on the 22nd their barograph registered a 945-millibar pressure after being adjusted to pick up the lower values. By this time the storm was turning a counterclockwise loop over Hokkaido. It weakened on the 23rd.

During the last week of the month, a huge Low pressure system with several centers stretched from the Gulf of Alaska southwestward to the Phillipine Sea. Several of these centers became intense for short periods of time. One 969-milibar center was spotted within the large circulation at 1200 on the 26th near 47.°N, 162°W). It moved northeastward then northward toward the Gulf of Alaska over the next few days. On the 27th, the ***Sea-Land Defender*** (58.4°N, 147.8°W) at 1800 battled 7.6-meter swells in 40-knot southerlies. At 0600 on the 28th, the ***President Hoover*** was nailed by 46-knot southwesterlies in 3.9-meter swells near 50.5°N, 134.2°W.



*The **President Grant** enroute from Pusan to Seattle ran into a storm on March 20 and recorded a 975-millibar pressure at about 0100. At that time they made the effort to record a special observation which indicated southwest winds of 70 knots and 10-meter swells.*

Casualties—Two Washington fishermen died when their 17.6-meter trawler ***Patsy B*** was swamped by an ocean swell and sank in frigid waters west of the Olympic Peninsula in mid-February. In South Korea on the 11th, the mv ***Feng Shun*** while awaiting cargo at Outer Anchorage, Busan dragged anchor and struck bottom due to a heavy swell and strong wind. The mv ***Tamamima*** encountered heavy weather causing minor damage in early February off Nagasaki.

March—The transitional season from winter to spring was underway on the climatic pressure charts as the subtropical high began to exert its influence across the Pacific. The Aleutian Low was centered over the Alaska Peninsula and the Gulf of Alaska, which is farther east than normal. Positive anomalies were most noticeable as pressure was higher than normal off the northwest coast of North America and over a good portion of the western North

Pacific. The upper air steering currents, on average, ran toward the east northeast with a northeastward turn east of 140°W.

Right off the bat, the Aleutian Low received input from a 972-millibar system in the Gulf of Alaska. The sprawling Low covered most of the northeastern North Pacific on the 1st. Winds in general were in the near gale force range. Several separate centers and an associated cold front complicated the weather problems for mariners and forecasters alike. The main center of the Low remained nearly stationary for a few days. It wasn't until the 4th that a large wedge of high pressure finally forced the system inland.

By this time another complex Low had developed near 40°N, 175°W. This 977-millibar center was the major one, but there were several secondary centers within the circulation. The main center moved northward and on the 7th combined with a secondary center near 47°N, 160°W by 0000 on the 8th. At this time, the KMJH (40.2°N, 173.4°W) hit 45-knot west southwesterlies in 4.5-meter swells. Six hours later these swells were estimated at 6.4 meters. By 1800 the ***Tai Shing*** (41.3°N, 152.9°W) ran into 48-knot south southeasterlies in 5.1-meter seas, and this was substantiated by the XYKM nearby who reported a 46-knot blow in 5.4-meter seas. The storm moved into the Gulf of Alaska on the 9th as a 976-millibar Low. Several secondary centers kept the circulation intact for the next several days and winds in the region remained at near gale force. On the 14th, a huge 1043-millibar High centered near 35°N, 160°W made its presence felt over a good portion of the eastern North Pacific. Several Lows to the west, near the dateline, were unable to penetrate this dome of high pressure but tightened the gradients along the western edge enough to produce some near gales during the mid portion of the month.

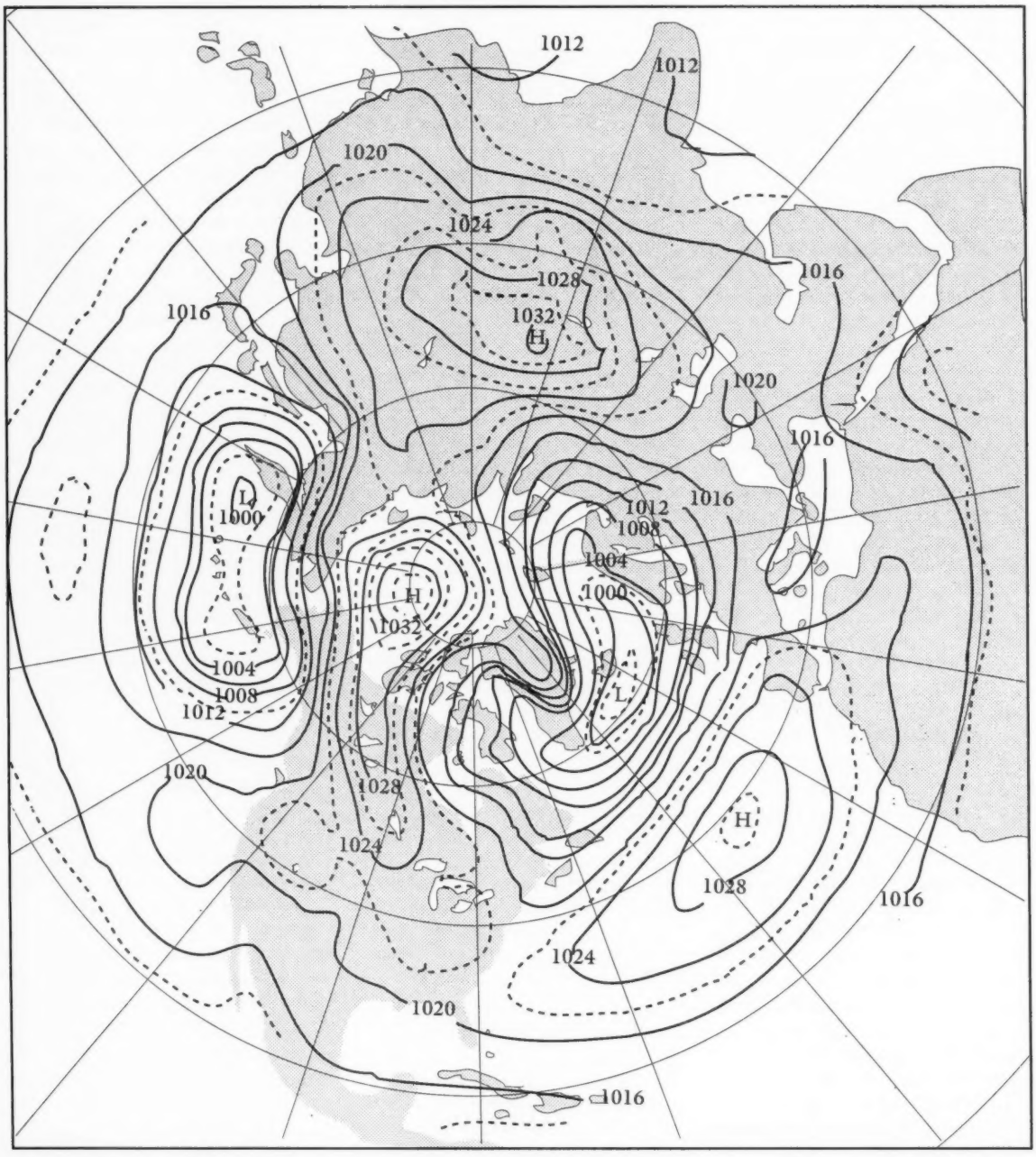
The High also forced cyclonic action of a moderate variety into the Gulf of Alaska and gradients there were tight enough to generate gales. No major storm systems were evident until the 22nd when two were analyzed. One was picked up over the eastern Aleutians with a 971-millibar center while another was discovered with a 960-millibar center near 42°N, 163°E. However, the real weather-producer was an underanalyzed system just south of the Queen Charlotte Islands. Pressures of 964 millibars and 965 millibars were recorded by the ***Oranienburg*** and A8LL respectively. And there were plenty more in the 970-millibar range to back these up. In fact at 0300 on the 23rd, the ***Great Land*** (54.5°N, 143.2°W) reported a 962-millibar pressure with 40-knot west northwesterlies in 7.6-meter swells. In general winds in the region ranged from 40 to 60 knots and swells of 15 to 30 feet were common. The ELOG7 (45.)°N, 151.6°W) at 0000 on the 22nd measured a 70-knot northwest wind with 10.9-meter seas and 11.8-meter swells. From the 21st to the 24th, conditions were horrendous in the seas between 45°N to 55°N from about 150°W to the coast.

The other two more prominent systems also created some problems but not to the extent of the coastal storms, and by the 24th they were both over Alaska.

This Japanese storm formed over Tokyo on the 23rd and went on to become part of another system which moved into the central Bering Sea and caused some problems to shipping toward the end of the month. The Japanese Low moved parallel to the islands and was organized enough, with a 976-millibar center on the 24th, to create some weather headaches for mariners during that period. However, once over the Kurils it began to move eastward and weaken. About this time, on the 25th, a new center developed over the tip of Kamchatka and began to assume control. By 0000 on the 27th, a 956-millibar monster was analyzed near 55°N and the dateline. Some 900 miles to the south, the ***California Orion*** was ripped by 57-knot westerlies in 10-meter swells and recorded a 988-millibar pressure. The 3ECM7 nearby came in with 48-knot westerlies in 7.9-meter seas. On the 28th, the storm weakened significantly as it approached the 60th parallel. Before the month was over a couple of more moderate Lows developed over the northern waters and Typhoon Owen was beginning to develop in the Philippine Sea.

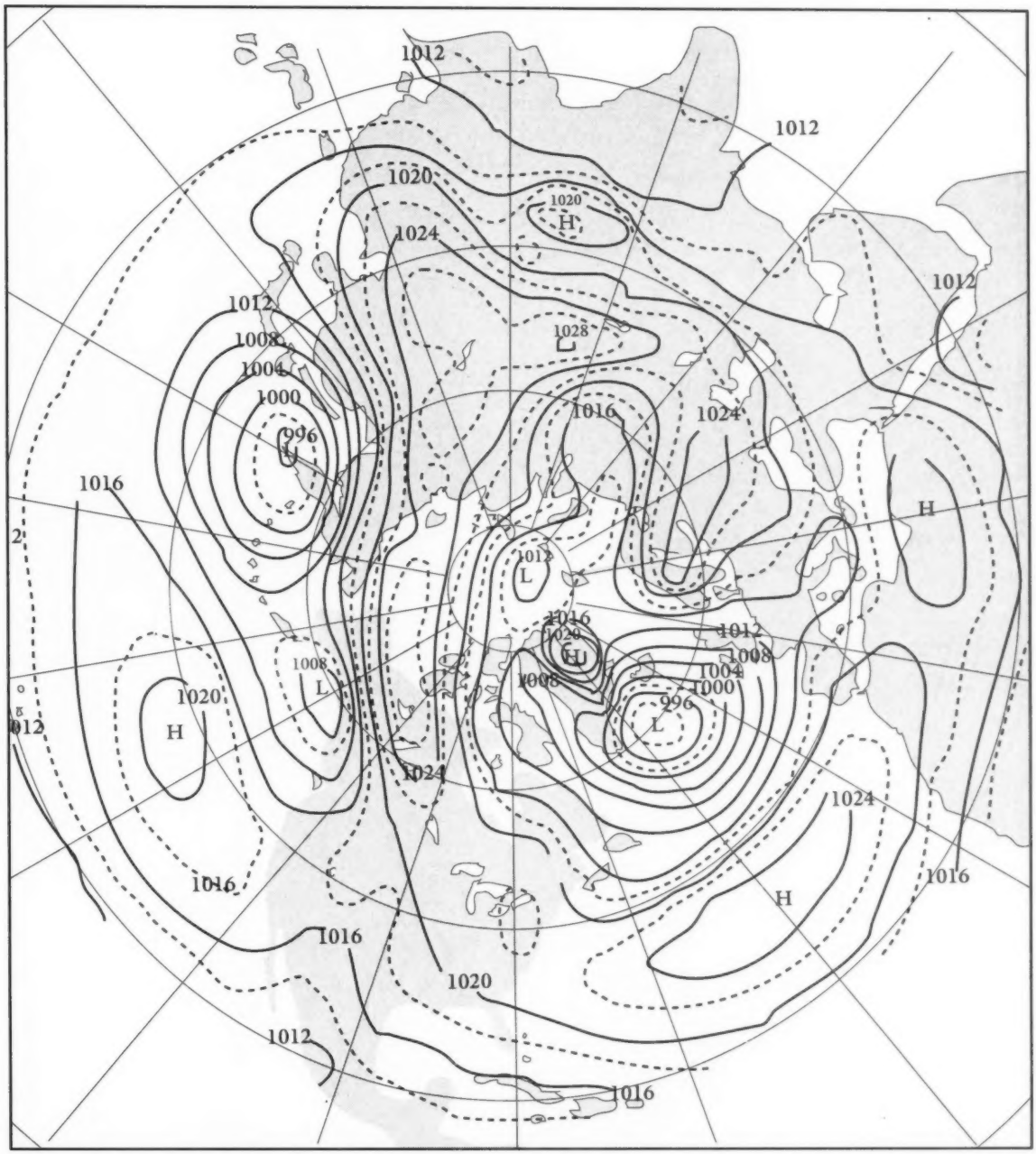
Casualties—On the 8th, the bulk carrier ***Adamastos*** grounded near Hong Kong in dense fog. Shortly after leaving the harbor, the 16,977-ton vessel ran aground but was later refloated with no damage. On the 2nd, a sprung watertight hatch caused flooding in the forward storage area of the 27-meter fv ***Misty Blue*** as it fished the Bering Sea. Flooding was compounded by heavy seas and heavy ice on deck. A Coast Guard C-130 delivered pumps to keep the vessel afloat.

January 1994



These Mean Sea Level Pressure charts were provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the *Climate Diagnostics Bulletin*.

February 1994



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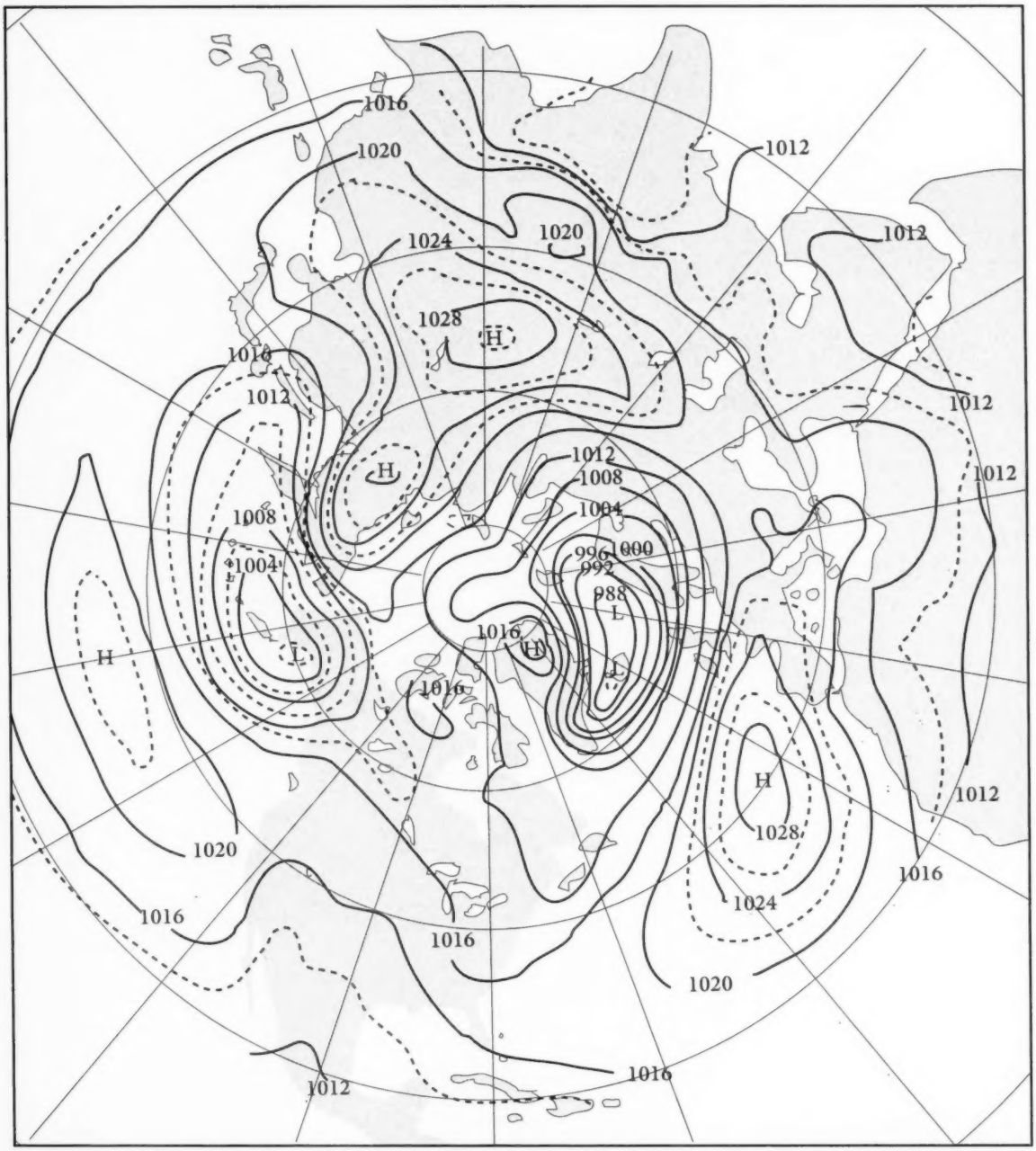
March 1994



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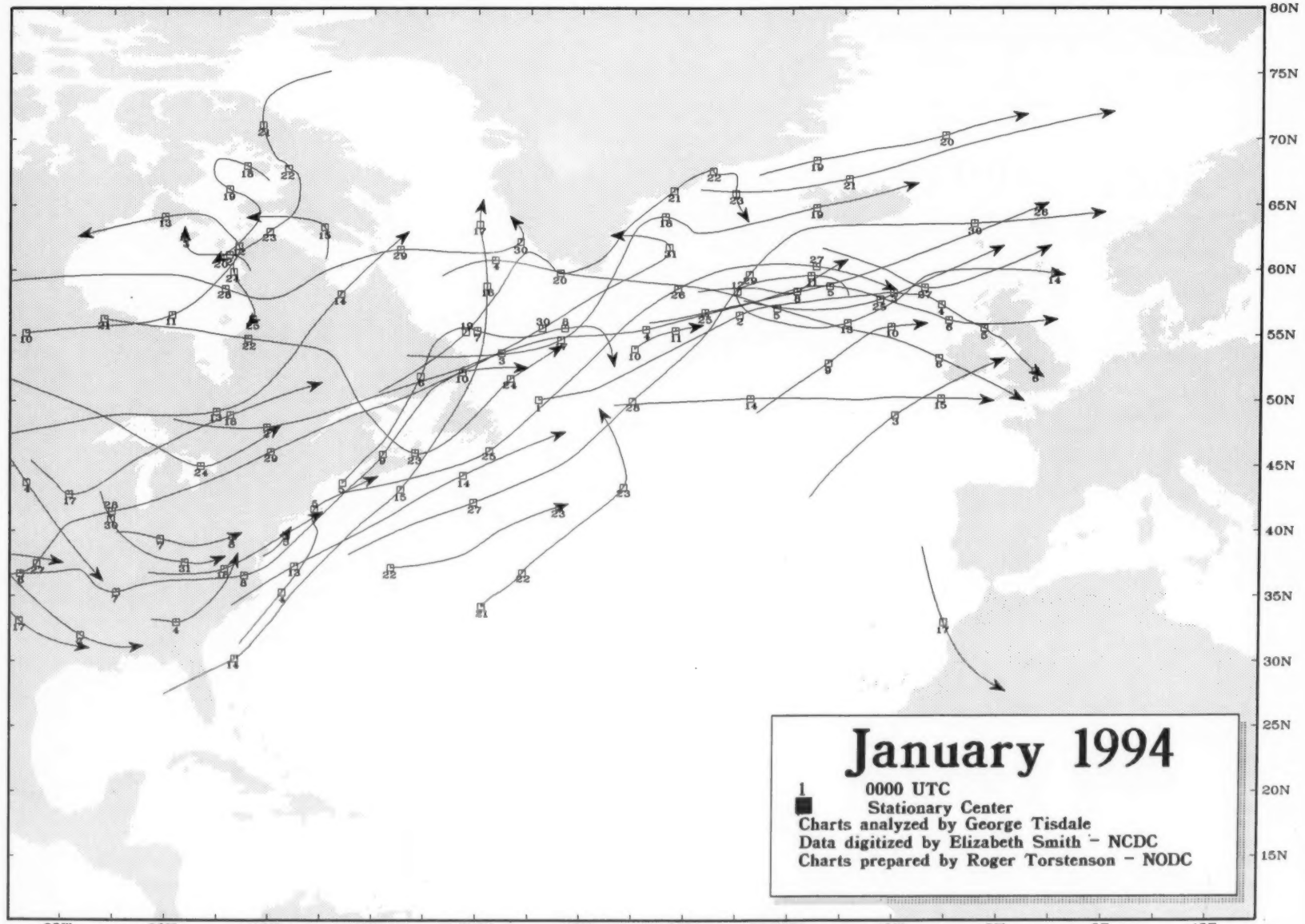
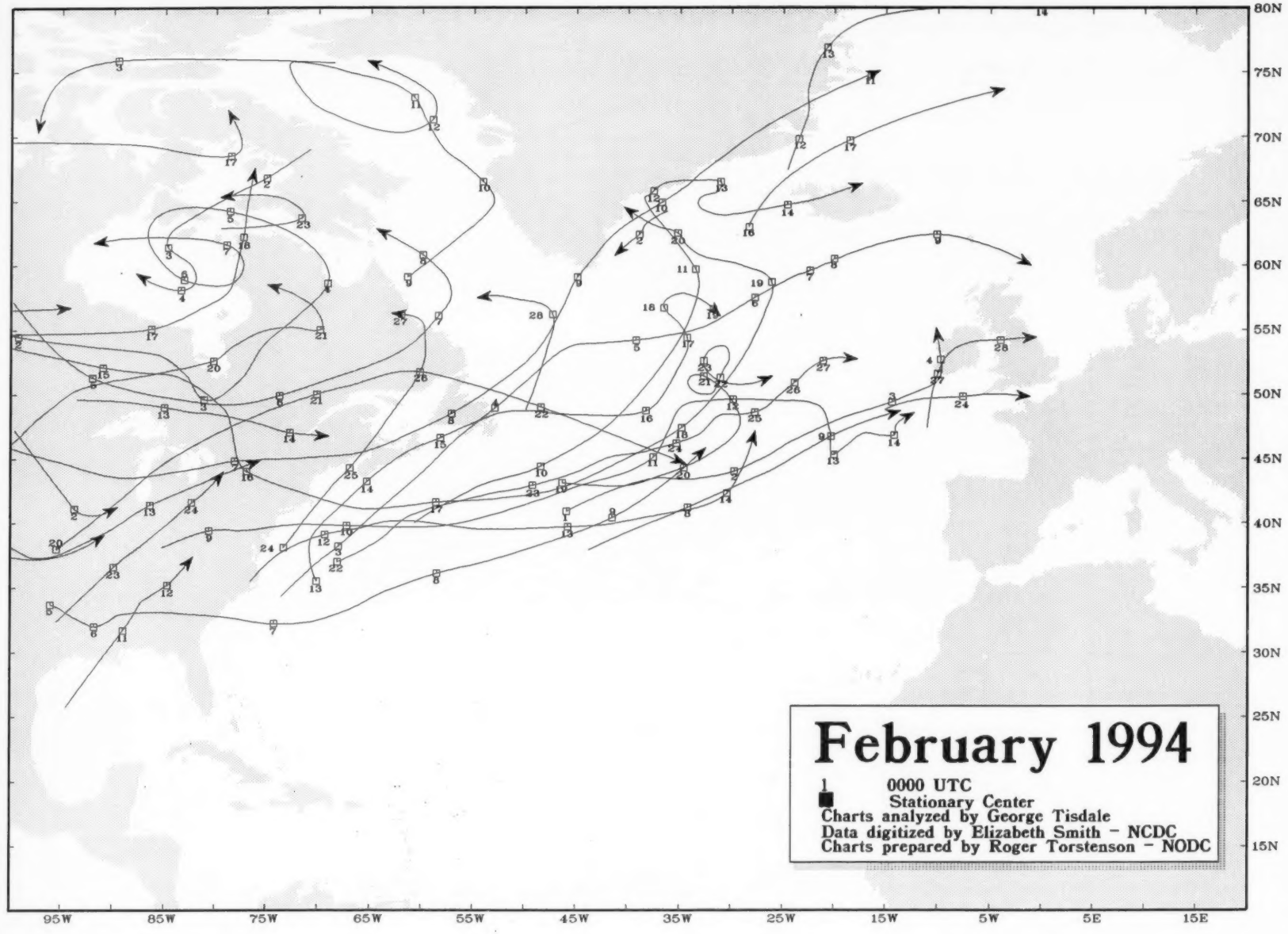
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



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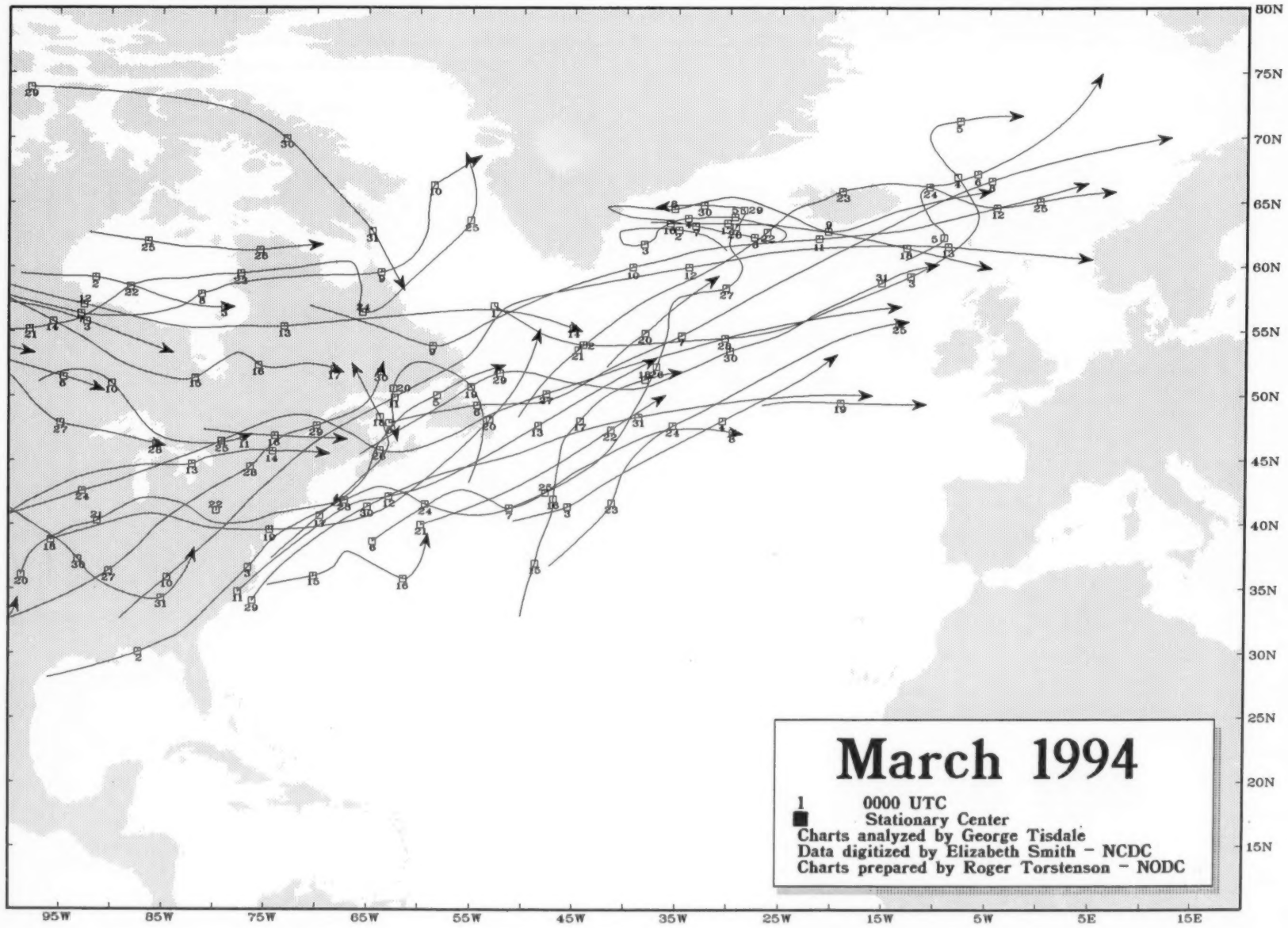
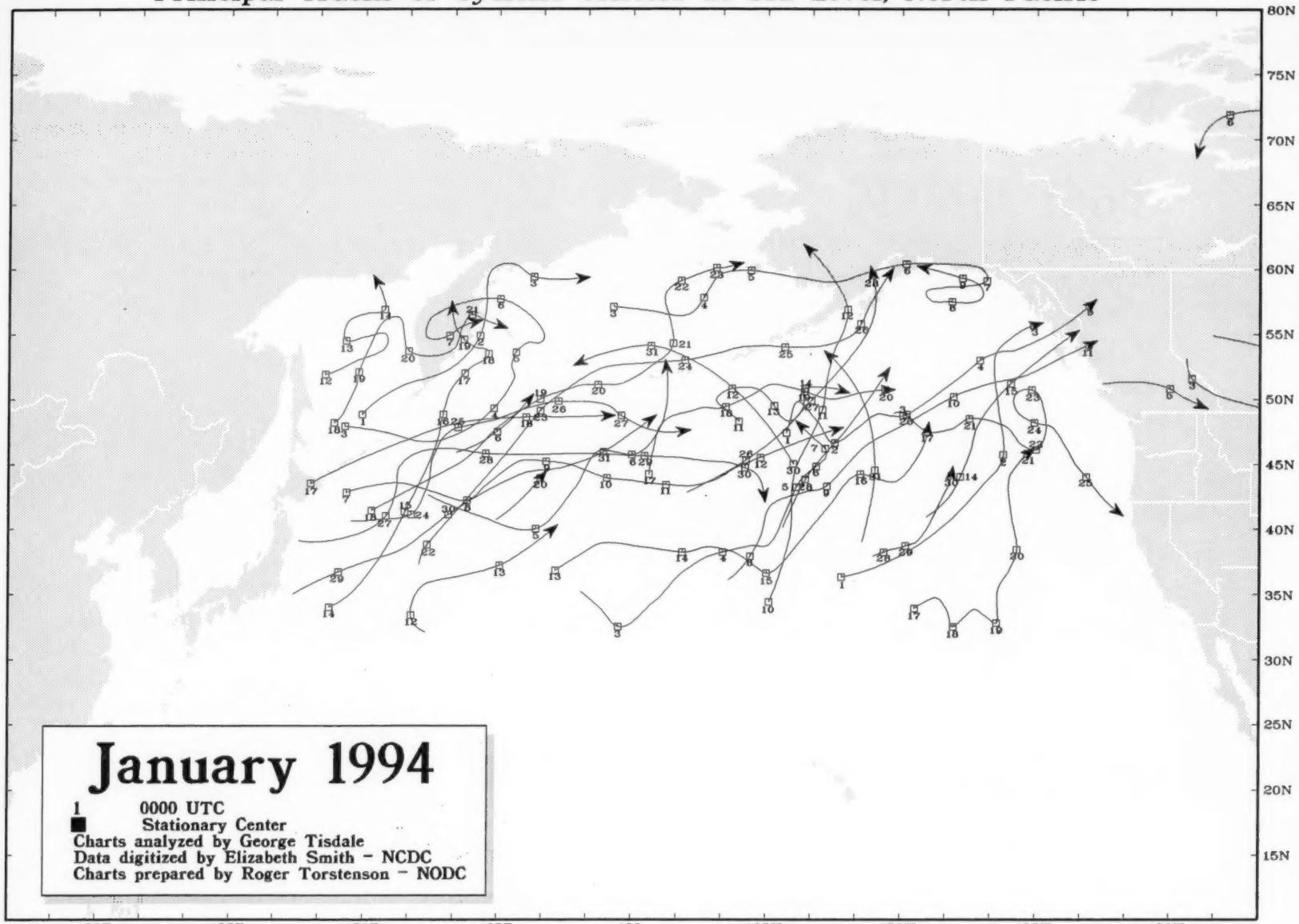
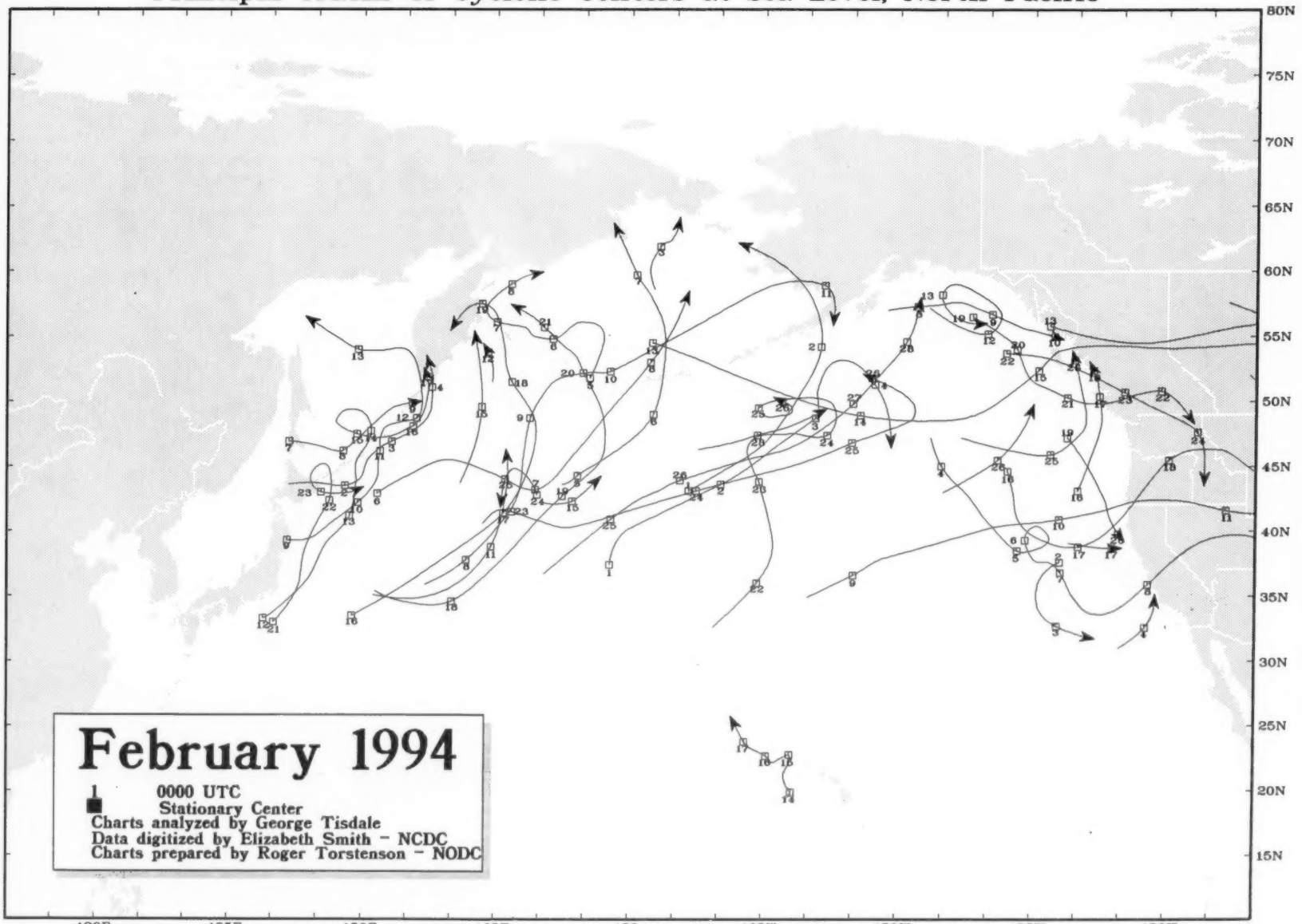


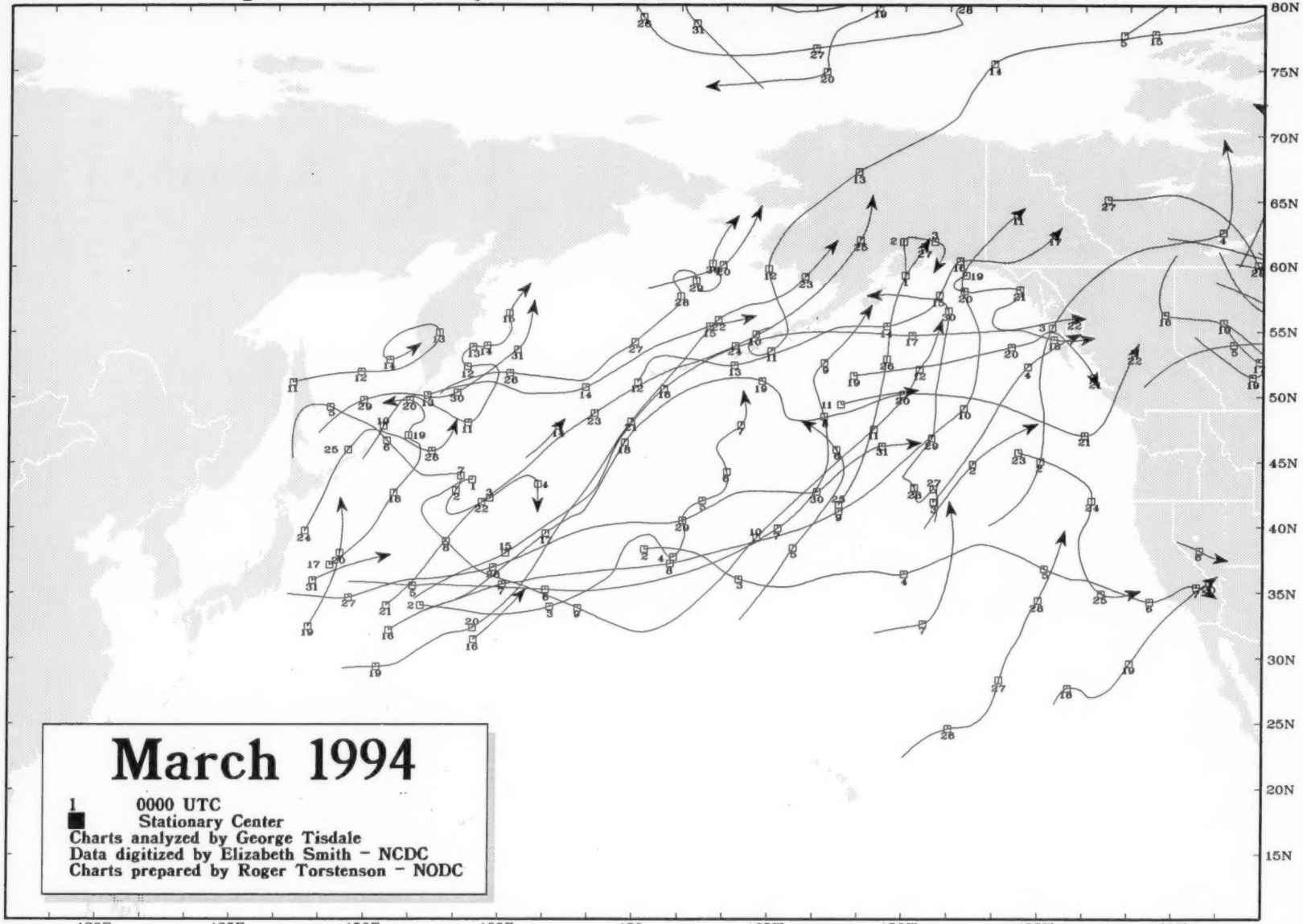
Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



January and February 1994

	RADIO	MAIL
1ST LT ALEX BONNYMAN	9	
1ST LT BALDOMERO LOPEZ	32	
1ST LT JACK LUMMUS	16	23
2ND LT. JOHN P. BOBO		63
A. V. KASTNER	180	
ACADIA FOREST	123	209
ACE ACCORD	19	
ACT 7	222	
ACT I	107	
ADABELLE LYKES	40	65
ADRIAN MAERSK	1	22
ADVANTAGE	65	23
AFRICAN CAMELLIA	38	
AGULHAS	61	56
ALBEMARLE ISLAND	31	29
ALBERNI DAWN	136	
ALBERT MAERSK	30	29
ALDEBARAN	1	
ALDEN W. CLAUSEN	17	
ALLIGATOR AMERICA	52	
ALLIGATOR COLUMBUS	74	110
ALLIGATOR EXCELLENCE	105	26
ALLIGATOR FORTUNE	34	
ALLIGATOR GLORY	60	128
ALLIGATOR HOPE	80	151
ALLIGATOR JOY	64	68
ALLIGATOR LIBERTY	128	
ALLIGATOR PRIDE	73	86
ALLIGATOR TRIUMPH	55	31
ALMANIA	20	28
ALMEDA STAR	32	
ALPENA	146	168
ALTAMONTE	39	
AMERICA STAR	130	
AMERICAN CONDOR	73	58
AMERICAN CORMORANT	5	
AMERICAN FALCON	63	78
AMERICAN KESTREL	15	
AMERICAN MARINER	29	16
AMERICAN REPUBLIC	24	46
AMERICAN VETERAN		36
AMERICANA	72	83
AMERIGO VESPUCCI	13	9
AMULET	50	21
ANAHUAC	5	
ANDERS MAERSK	103	120
ANNA	51	
ANNA MAERSK	85	43
APJ SHALIN	10	57
ARABIAN SENATOR	224	
ARCO ALASKA		38
ARCO ANCHORAGE	30	30
ARCO CALIFORNIA		53
ARCO FAIRBANKS	53	36
ARCO JUNEAU	5	17
ARCO SPIRIT	3	19
ARCO TEXAS	33	32
ARCTIC OCEAN	11	80
ARGONAUT	63	146
ARIES	15	
ARILD MAERSK	33	
ARMCO	79	101
ARNOLD MAERSK		45
ARTHUR M. ANDERSON	91	108
ARTHUR MAERSK	43	169
ASHLEY LYKES	74	
ASIAN SENATOR	3	
ATIGUN PASS	76	48
ATLANTA BAY	51	
ATLANTIC CARTIER	46	
ATLANTIC COMPASS	85	
ATLANTIC CONVEYOR	83	
ATLANTIC OCEAN	18	30
ATLANTIS II	26	
ATLAS HIGHWAY	17	28
AUSTRAL RAINBOW	21	32
AUTHOR	62	
AVELONA STAR	51	
AXEL MAERSK	10	122
AYA II	126	
B.T. ALASKA	86	33
BAAB ULLAH	9	
BALTIC SUN	66	
BALTIMORE TRADER	112	193
BARBARA ANDRIE	89	61
BARRINGTON ISLAND	85	59
BAY BRIDGE	119	133
BEBEDOURO	143	110
BIBI	186	
BLUE RIDGE	140	126
BOGASARI LIMA	133	
BONN EXPRESS	127	
BOSPORUS BRIDGE	189	204
BOVEC	87	
BP ADVENTURE	68	
BRAVERY	45	43
BRAZILIAN REEFER	10	
BREMEN EXPRESS	12	
BRIDGETON	71	
BRIGIT MAERSK	40	19
BRISBANE STAR	43	
BROOKLYN BRIDGE	185	64
BROOKS RANGE	40	38
BRUCE SMART	41	61
BT NAUTILUS	20	
BUCKEYE	302	318
BUNGA KENANGA	2	
BUNGA KESIDANG	35	
BURDUR	1	36
BURNS HARBOR	411	462
CALCITE II	112	123
CALIFORNIA CERES	78	
CALIFORNIA HERMES	99	
CALIFORNIA LUNA	61	
CALIFORNIA MERCURY	159	
CALIFORNIA ORION	52	43
CALIFORNIA PEGASUS	91	
CALIFORNIA STAR	116	
CALIFORNIA TRITON	89	62
CALIFORNIA ZEUS	43	
CANADIAN LIBERTY	65	28
CAP PALMAS	20	117
CAPE DECISION	19	
CAPE DOUGLAS	49	36
CAPE HATTERAS	37	
CAPE HUDSON	74	79
CAPE MAY	130	
CARINA	41	65
CARLA A. HILLS	109	179
CARMEL	28	73
CAROLINA	60	56
CARTAGENA	88	72
CASON J. CALLAWAY	189	211
CASSIA	11	
CATHAY SPIRIT	27	
CCNI ANTARTICO	45	19
CEDRELA	17	
CELEBRATION	25	18
CENTURY HIGHWAY #2	49	
CENTURY HIGHWAY NO. 1	93	
CENTURY HIGHWAY NO. 5	256	
CENTURY HIGHWAY_NO. 3	95	
CENTURY LEADER NO. 1	69	
CGM LORRAINE	16	
CHACABUCO	97	115
CHARLES LYKES	75	224
CHARLES M. BEEGHLEY	43	
CHARLES PIGOTT		48
CHARLESTON	13	
CHARLOTTE LYKES	44	79
CHC NO.1	14	18
CHEMICAL PIONEER	60	51
CHERRY VALLEY	40	24
CHESAPEAKE TRADER	114	57
CHESTNUT HILL	21	24
CHEVRON ANTWERP	29	19
CHEVRON ATLANTIC		152
CHEVRON BURNABY	65	34
CHEVRON CALIFORNIA	145	172
CHEVRON COLORADO	27	41
CHEVRON EDINBURGH	123	185
CHEVRON FELUY		62
CHEVRON MISSISSIPPI	12	13
CHEVRON OREGON	1	2
CHEVRON PACIFIC	4	34
CHEVRON STAR		27
CHEVRON WASHINGTON	50	66
CHIQUITA BOCAS	15	
CHIQUITA CINCINNATIAN	50	99
CHIQUITA ITALIA	89	
CHIQUITA JEAN	95	
CHIQUITA SCANDINAVIA	124	
CHOAPA	10	
CIELO DI FIRENZE	51	23
CLEMENTINA	49	
CLEVELAND	12	17
CO-OP EXPRESO	52	48
COAST RANGE	13	28
COASTAL EAGLE POINT	4	
COASTAL MANATEE	70	29
COLLEEN SIF	157	167
COLUMBIA BAY	7	
COLUMBIA STAR	315	97
COLUMBUS AMERICA	401	
COLUMBUS AUSTRALIA	130	
COLUMBUS CALIFORNIA	175	
COLUMBUS ISELIN	15	
COLUMBUS NEW ZEALAND	130	
COLUMBUS OHIO	43	39
COLUMBUS QUEENSLAND	111	
COLUMBUS VICTORIA	164	
COLUMBUS WELLINGTON	215	
COMPANION EXPRESS	68	
CONCERT EXPRESS	26	
CONDOLEEZZA RICE	6	
CONTIENTAL WING	127	
CONTSHIP AUSTRALIA	41	
CONTSHIP ENGLAND	12	
CORAH ANN	67	27
CORNUCOPIA	41	120
CORONADO	29	41
CORPUS CHRISTI	148	68
CORWITH CRAMER	103	118
COURIER	39	16
COURTNEY BURTON	105	181
COURTNEY L.	148	211
CPL. LOUIS J. HAUGE JR	17	34
CRISTOFORO COLOMBO	40	48
CROWN PRINCESS	95	
CSL ATLAS	179	
CSL INNOVATOR	58	
CSS HUDSON	119	
DAMODAR KAVERI	20	
DAN MOORE	2	
DANIELLA	86	
DEL MONTE CONSUMER	98	87
DEL MONTE HARVESTER	1	
DEL MONTE TRADER	82	
DELAWARE TRADER	147	1
DELMONTE TRANSPORTER	70	88
DIANA	8	6
DIRECT FALCON	126	201
DIRECT KEA	151	
DIRECT KIWI	100	
DIRECT KOOKABURRA	145	169
DMITRIY OLYANOV	33	
DOCTOR LYKES	167	68
DOLE CALIFORNIA	7	
DON JORGE	11	
DOROTHEE	132	312
DOUBLE GLORY	39	
DSR BALTIC	119	
DSR EUROPE	199	
DUSSELDORF EXPRESS	83	
DYVI BALTIC	17	10
DYVI OCEANIC	95	
E.P. LE QUEBECOIS	235	
ECSTASY	88	131
EDGAR B. SPEER	216	254
EDINBURGH FRUID	22	
EDWARD L. RYERSON	130	165
EDWIN H. GOTT	238	244
EDYTH L.	104	99
EIBE OLDENDORFF		79
ELIZABETH LYKES	14	29
ELIZABETH OLDENDORFF	3	
ELLEN KNUDSEN	24	
ELLENSBORG		61
EMMA OLDENDORFF	74	
ENCHANTED SEAS	3	18
ENDEAVOR 2	4	
EUROPEAN SENATOR	41	
EVER GAINING	6	
EVER GATHER	14	15
EVER GENTLE	4	
EVER GENTRY	11	31
EVER GIANT	10	
EVER GIVEN	10	
EVER GLAMOUR	17	
EVER GLEAMY	11	11
EVER GLOBE	8	1
EVER GLORY	18	22
EVER GLOWING	48	48
EVER GOING	9	
EVER GOODS	26	77
EVER GRADE	10	
EVER GROUP	22	
EVER GROWTH	3	
EVER GUARD	8	
EVER GUEST	1	

January and February 1994

	RADIO	MAIL
EVER GUIDE	4	10
EVER LAUREL	34	
EVER LEVEL	27	14
EVER LINKING	8	
EVER LIVING	26	
EVER LYRIC	17	
EXPORT FREEDOM	38	56
EXPORT PATRIOT	45	98
FAIRLIFT	129	
FAIRMAST	73	
FALSTAFF	11	
FANTASY	5	
FAUST	62	92
FEDERAL SKEENA	60	
FERNCROFT	154	20
FESTIVALE	3	26
FETISH	147	156
FIESTAMARINA	47	49
FIR GROVE	46	33
FOREST HAWK	35	
FRANCES HAMMER	154	84
FRANCES L.	81	114
FRED G.	53	
FRED R. WHITE JR	30	36
FREJA ISLANDIA	55	
FREJA SVEA	129	131
FRINES	63	
FUJI	25	
GALVESTON BAY	119	206
GENEVIEVE LYKES	31	38
GEORGE A. SLOAN	123	151
GEORGE A. STINSON	74	93
GEORGE H. WEYERHAEUSER	45	149
GEORGE WASHINGTON BRID	211	27
GEORGIA		101
GEORGIA RAINBOW II	49	
GERMAN SENATOR	40	
GERONIMO	5	
GLOBAL LINK	3	
GLOBAL SENTINEL	114	
GOLDEN APO	5	
GOLDEN GATE	12	
GOLDEN GATE BRIDGE	207	44
GOLDEN MONARCH	1	
GREAT LAND	3	
GREEN BAY	39	38
GREEN CEDAR	53	
GREEN HARBOUR	14	
GREEN ISLAND	29	48
GREEN LAKE	105	115
GREEN MAYA	111	
GREEN RIDGE	86	45
GREEN SASEBO	81	52
GREEN SUMA	71	96
GREEN SYLVAN	24	6
GREEN VALLEY	13	
GREEN WAVE	20	
GROWTH RING	99	57
GUAYAMA	13	7
GULF SPEED	102	
GULF SPIRIT	28	
GYPSUM BARON	186	
GYPSUM KING	119	
H. LEE WHITE	147	179
HANJIN BREMEN	6	
HANJIN CHUNGMU	54	
HANJIN FELIXSTOWE	15	
HANJIN HAMBURG	14	
HANJIN HONG KONG	24	
HANJIN KAOHSIUNG	1	
HANJIN KEELUNG	22	
HANJIN KOBE	24	32
HANJIN LONG BEACH		3
HANJIN MARSEILLES	8	
HANJIN MASAN	35	
HANJIN NEW YORK	36	32
HANJIN OAKLAND	13	6
HANJIN ROTTERDAM	16	
HANJIN SAVANNAH	49	33
HANJIN SEATTLE	9	
HANJIN TONGHAE	17	
HANJIN VANCOUVER	13	
HANJIN YOKOHAMA	28	
HANSA LUBECK	206	85
HANSA VISBY	35	
HEIDELBERG EXPRESS	99	
HENRY HUDSON BRIDGE	222	
HERBERT C. JACKSON	43	49
HEREFORDSHIRE	3	
HERMENIA	81	46
HERMOD	54	
HETTSTEDT	75	
HIBISCUS	90	96
HIRA II		17
HOEGH CLIPPER	13	29
HOEGH DUKE	5	
HOEGH DYKE	17	
HOEGH MERCHANT	5	
HOEGH MINERVA	10	
HOLIDAY	89	99
HONESTA	18	
HOWELL LYKES	67	32
HUAL INGRITA	30	17
HUAL KARINITA	20	
HUAL ROLITA	19	64
HUMACAO	71	107
HUMBERGRACHT	33	
HUNG CHOW	393	
HYUNDAI CONTINENTAL	38	
HYUNDAI DUKE	13	
IBN AL-ATHEER	90	
IBN AL-MOATAZ	17	
INDEPENDENT ACCORD	31	
INDEPENDENT SPIRIT	14	
INDIAN OCEAN		4
INDIANA HARBOR	57	78
INFANTA	204	
INGER	100	24
IOWA TRADER	26	25
ISABELLA	41	
ISLAND PRINCESS	46	
ITB BALTIMORE	46	49
ITB GROTON	86	105
ITB JACKSONVILLE	140	153
ITB MOBILE	22	44
ITB NEW YORK	49	36
ITB PHILADELPHIA	9	5
IVER EXPLORER	60	
IVER EXPRESS	19	
J. DENNIS BONNEY		199
J.W. POWELL	42	
JAHRE SPIRIT	39	
JALAVIHAR	22	37
JALISCO	46	77
JAMES LYKES	65	131
JAMES R. BARKER	142	150
JAPAN RAINBOW 2	72	
JAPAN SENATOR	295	
JEAN LYKES	39	96
JEBEL ALI	35	
JO OAK	1	
JOHN G. MUNSON	306	321
JOHN J. BOLAND	65	88
JOHN LYKES	37	37
JOHN YOUNG		54
JOSEPH H. FRANTZ	222	180
JOSEPH L. BLOCK	71	109
JUBILANT	8	
JUBILEE	11	10
JULIUS HAMMER	142	
KAIMOKU	153	108
KAINALU	155	102
KAKUSHIMA	41	43
KANSAS TRADER	64	46
KAREN ANDRIE	37	
KAUAI	5	
KAYE E. BARKER	97	109
KEE LUNG	45	42
KEISHO MARU	45	
KELVIN CHALLENGE	11	
KENAI	150	201
KENNETH E. HILL	55	52
KENNETH T. DERR	104	166
KENTUCKY HIGHWAY	26	
KEYSTONE CANYON	53	41
KEYSTONER	42	51
KINSMAN ENTERPRISE	3	43
KITTANING	7	14
KOLN EXPRESS	152	
KOPER EXPRESS	36	
KRAS	64	
KURE	16	
LA TRINITY	20	33
LAKE GUARDIAN	9	10
LAUST MAERSK	20	36
LAWRENCE H. GIANELLA	8	1
LEISE MAERSK	1	
LEON	10	
LEONARD J. COWLEY	89	
LEONIA	176	
LERMA	57	
LESLIE LYKES	67	141
LETITIA LYKES	49	66
LIBERTY BELLE	18	36
LIBERTY SEA	25	81
LIBERTY SPIRIT	35	
LIBERTY STAR	34	62
LIBERTY SUN	84	150
LIBERTY VICTORY	9	52
LIBERTY WAVE	24	21
LIRCAY	127	58
LNG AQUARIUS	24	108
LNG CAPRICORN	14	17
LNG LEO	17	34
LNG TAURUS	26	130
LNG VIRGO	88	144
LOA	59	
LONDON ENTERPRISE	83	
LONG LINES	11	
LONGAVI	221	
LOUISE LYKES	31	
LOUISIANA	37	
LT ARGOSY	6	
LT PRAGATI	32	
LT. ODYSSEY	9	
LUCKY BULKER	36	
LUNA MAERSK	92	139
LURLINE	71	182
M. P. GRACE	15	
M/S MAASDAM	29	
M T LONDON SPIRIT	50	
MACKINAC BRIDGE	198	40
MADISON MAERSK	52	30
MAERSK CONSTELLATION	59	91
MAERSK JEDDAH	66	70
MAERSK SANTIAGO	47	127
MAERSK SUN	67	98
MAERSK TACOMA	1	
MAGIC	127	
MAGLEBY MAERSK	30	35
MAJ STEPHEN W PLESS MP	3	10
MAJESTIC MAERSK	35	64
MANILA SUNRISE	38	
MANITOU		2
MANUKAI	75	169
MANULANI	92	184
MARATHA MAJESTY	3	
MARCHEN MAERSK	1	15
MAREN MAERSK	55	104
MARGARET LYKES	52	51
MARGRETHE MAERSK	21	70
MARIA TOPIC	1	66
MARIE MAERSK	55	116
MARIF	36	47
MARINE PRINCESS	15	8
MARINE RELIANCE	126	
MARIT MAERSK	19	92
MARJORIE LYKES	40	50
MARLIN		114
MATHILDE MAERSK		61
MATSONIA	123	176
MAUI	43	146
MAURICE EWING	7	133
MAURICIO DE OLIVEIRA	1	
MAYA	25	
MAYAGUEZ	95	73
MAYVIEW MAERSK	23	88
MC-KINNEY MAERSK	32	54
MEDALLION	71	60
MEDUSA CHALLENGER	356	407
MELBOURNE STAR	125	
MELVILLE	109	107
MERCANDIAN CONTINENT	55	22
MERCHANT PRELUDE	45	
MERCHANT PREMIER	76	
MERCHANT PRINCIPAL	155	
MERCURY ACE	6	
MERIDA	88	
MESABI MINER	131	155
METTE MAERSK	13	4
MICHIGAN	229	310
MICHIGAN HIGHWAY	47	
MICRONESIAN COMMERCE	23	
MICRONESIAN INDEPENDEN	3	
MICRONESIAN PRIDE	112	
MIDDLETOWN	85	124
MINERVA	13	
MING PLENTY	49	43
MING PROMINENCE	36	
MING PROMOTION	35	
MING PROSPERITY	2	
MITLA	119	64
MIXTECO	84	

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	RADIO	MAIL
MOANA PACIFIC	140	
MOKU PAHU	106	58
MONTERREY	133	41
MORELOS	131	70
MORMACSKY	16	
MORMACSTAR	23	21
MORMACSUN	71	
MT. CABRIT	11	
MYRON C. TAYLOR	138	175
MYSTIC	121	
NACIONAL SANTOS	1	
NAPIER STAR	2	
NARA	100	40
NATIONAL DIGNITY	31	75
NATIONAL HONOR	20	25
NATIONAL PRIDE	19	45
NCC ARAR	10	
NEDLLOYD HOLLAND	64	57
NEDLLOYD MADRAS	10	
NEDLLOYD MARSEILLS	26	
NEDLLOYD ROTTERDAM	160	
NEDLLOYD TOKYO	56	
NEDLLOYD VAN CLOON	103	
NEDLLOYD VAN DIEMEN	9	
NEDLLOYD VAN NECK	67	
NEDLLOYD VAN NOORT	142	
NEPTUNE ACE	60	
NEPTUNE AMBER	20	
NEPTUNE AZURITE	51	
NEPTUNE CORAL	26	
NEPTUNE CRYSTAL	35	
NEPTUNE DIAMOND	100	
NEPTUNE GARNET	48	
NEPTUNE JADE	20	
NEPTUNE PEARL	29	
NEW HORIZON	28	45
NEW NOBLE	15	
NEW YORK SENATOR	14	
NEWARK BAY	78	37
NIEUW AMSTERDAM	78	
NIPPON HIGHWAY	2	
NOAA DAVID STARR JORDA	111	71
NOAA SHIP CHAPMAN	243	250
NOAA SHIP DELAWARE II	120	284
NOAA SHIP DISCOVERER O	454	477
NOAA SHIP FERREL	13	106
NOAA SHIP HECK 591	1	
NOAA SHIP M. BALDRIDGE	28	22
NOAA SHIP MCARTHUR	432	195
NOAA SHIP MILLER FREEM	126	207
NOAA SHIP MT MITCHELL	36	
NOAA SHIP OREGON II	371	284
NOAA SHIP RAINIER	118	
NOAA SHIP SURVEYOR	125	202
NOAA SHIP T. CROMWELL	8	148
NOAA SHIP WHITING	257	307
NOBEL STAR	67	20
NORD JAHRE TARGET	5	
NORTHERN LIGHTS	194	235
NOSAC CEDAR	29	
NOSAC EXPLORER	3	
NOSAC EXPRESS	18	
NOSAC FOREST	126	
NOSAC RANGER	91	151
NOSAC ROVER	9	
NOSAC TAKAYAMA		256
NUEVO SAN JUAN	36	75
NURNBERG ATLANTIC	178	
NYK SPRINGTIDE	210	
NYK STARLIGHT	59	
NYK SURFWIND	36	
OAXACA	149	176
OBO ENGIN	11	
OCEAN BRIDGE	21	
OCEAN CHEER	9	
OCEAN HIGHWAY	43	
OCEAN SPIRIT	368	
OCEAN VICTOR	65	35
ODELIA	10	5
OLEANDER	152	83
OMI MISSOURI	31	
OMI WILLAMETTE	76	55
OOCL BRAVERY	85	
OOCL EDUCATOR	42	
OOCL ENVOY	62	21
OOCL EXECUTIVE	74	35
OOCL EXPLORER	88	76
OOCL EXPORTER	109	
OOCL FAIR	85	
OOCL FAITH	20	
OOCL FAME	94	
OOCL FIDELITY	109	69
OOCL FORTUNE	118	9
OOCL FREEDOM	61	
OOCL FRIENDSHIP	73	
OOCL INNOVATION	80	59
OOCL INSPIRATION	126	36
ORANGE BLOSSOM	22	
ORANGE STAR	22	130
ORANGE WAVE		67
OREGON STAR	169	
ORION HIGHWAY	117	41
OURO DO BRASIL	133	107
OVERSEAS ALASKA	59	24
OVERSEAS ALICE	3	
OVERSEAS ARCTIC	56	
OVERSEAS CHICAGO	28	144
OVERSEAS HARRIET	1	
OVERSEAS JOYCE	52	
OVERSEAS JUNEAU		58
OVERSEAS MARILYN	33	
OVERSEAS NEW ORLEANS	70	30
OVERSEAS NEW YORK	37	129
OVERSEAS OHIO	23	66
OVERSEAS PHILADELPHIA		45
PACASIA	53	
PACIFIC EMERALD	1	5
PACIFIC PRINCESS	143	
PACKING	18	
PACMERCHANT	53	
PACOCEAN	29	
PACPRINCE	36	
PACPRINCESS	36	
PACQUEEN	38	15
PACSTAR	13	
PAPAGO	65	88
PARIS SENATOR	6	
PATRIOT	19	2
PAUL BUCK	50	31
PAUL H. TOWNSEND	222	208
PAUL R. TREGURTHA	325	365
PC EXPLORER		26
PERMEKE	10	
PETER W. ANDERSON	37	
PETROBULK PROGRESS	2	
PFC DEWAYNE T. WILLIAM	50	
PFC EUGENE A. OBREGON	42	14
PFC JAMES ANDERSON JR	12	20
PHAROS	38	
PHILIP R. CLARKE	130	151
PHOENIX DIAMOND	56	
PIERRE FORTIN	295	
PISCES PLANTER	154	
PLATTE	29	13
POLAR ALASKA	53	144
POLYNESIA	183	141
POTOMAC	33	
PRESIDENT ADAMS	98	87
PRESIDENT ARTHUR	65	66
PRESIDENT BUCHANAN	23	21
PRESIDENT EISENHOWER	138	181
PRESIDENT F. ROOSEVELT	207	193
PRESIDENT FILMORE	40	33
PRESIDENT GARFIELD	45	
PRESIDENT GRANT	74	81
PRESIDENT HARDING	62	
PRESIDENT HARRISON	89	
PRESIDENT HOOVER	43	110
PRESIDENT JACKSON	151	187
PRESIDENT JEFFERSON	60	113
PRESIDENT KENNEDY	144	75
PRESIDENT LINCOLN	51	209
PRESIDENT MONROE	162	163
PRESIDENT POLK	165	166
PRESIDENT TRUMAN	31	115
PRESIDENT TYLER	35	107
PRESIDENT VAN BUREN	14	
PRESIDENT WASHINGTON	126	221
PRESQUE ISLE	287	337
PRIDE OF BALTIMORE	74	
PRINCE OF OCEAN	87	168
PRINCE OF TOKYO	119	64
PRINCE OF TOKYO 2	106	187
PRINCE WILLIAM SOUND	23	95
PUEBLA	85	
PUERTO CORTES	98	
PVT FRANKLIN J. PHILLI	14	18
PYTCHLEY	178	
QUEEN ELIZABETH 2	142	
QUEENSLAND STAR	167	
R.J. PFEIFFER	144	122
RAINBOW HOPE	121	135
RAINBOW WARRIOR	2	
RALEIGH BAY	79	172
RANGER III	1	
RANI PADMINI	54	
RECIFE	389	68
REGAL EMPRESS	2	
REPULSE BAY	77	
RESERVE	124	152
RESOLUTE	61	158
RHINE FOREST	82	11
RICHARD G MATTIESEN	45	45
RICHARD REISS	89	
RIJEKA EXPRESS	1	
ROBERT E. LEE	10	
ROSINA TOPIC	29	39
ROTTERDAM	157	
ROVER	22	
ROWANBANK	100	
ROYAL PRINCESS	91	
RUBIN DOGA	42	
RUBIN OCEAN	24	6
RUTH LYKES	31	53
S.T. CRAPO	152	190
SALINA CRUZ PILOTS	185	31
SALINAS	23	117
SAM HOUSTON	20	
SAMUAL GINN	34	84
SAMUEL H. ARMACOST	63	73
SAMUEL L. COBB	59	24
SAMUEL RISLEY	570	
SAN LORENZO	11	
SAN LUIS	19	
SAN MARCOS	94	73
SAN MARTIN	54	
SAN PEDRO	91	
SAN VINCENTE	28	
SANTA FE		24
SANTA FE DE BOGOTA	15	
SANTA MARTA	21	
SANTA MONICA	94	
SANTA PAULA	119	139
SANTORIN 2	91	315
SAPAI	5	
SAVANNAH	45	
SCARAB	5	
SEA BELLS	34	188
SEA COMMERCE	110	40
SEA FAN	37	82
SEA FORTUNE	43	102
SEA FOX	65	
SEA LIGHT	28	22
SEA LION	272	264
SEA MERCHANT	352	292
SEA SPRAY	3	
SEA TRADE	16	
SEA WOLF	147	95
SEA-LAND SHINING STAR	105	106
SEABOARD OCEAN	239	249
SEABOARD SUN	43	44
SEALAND ACHIEVER	149	92
SEALAND ANCHORAGE	75	149
SEALAND ATLANTIC	71	132
SEALAND CHALLENGER	72	152
SEALAND CONSUMER	195	120
SEALAND CRUSADER	143	94
SEALAND DEFENDER	74	128
SEALAND DEVELOPER	90	156
SEALAND DISCOVERY	39	
SEALAND ENDURANCE	83	118
SEALAND ENTERPRISE	157	144
SEALAND EXPEDITION	44	52
SEALAND EXPLORER	102	126
SEALAND EXPRESS	184	117
SEALAND HAWAII	238	249
SEALAND INDEPENDENCE	87	40
SEALAND INNOVATOR	92	76
SEALAND INTEGRITY	225	189
SEALAND LIBERATOR	60	86
SEALAND MARINER	82	38
SEALAND NAVIGATOR	197	100
SEALAND PACIFIC	233	151
SEALAND PATRIOT	53	
SEALAND PERFORMANCE	25	151
SEALAND PRODUCER	87	200
SEALAND QUALITY	73	69
SEALAND RELIANCE	122	227
SEALAND SPIRIT	105	226
SEALAND TACOMA	43	48

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	RADIO	MAIL
SEALAND TRADER	223	224
SEALAND VALUE	64	137
SEALAND VOYAGER	86	51
SEARIVER BATON ROUGE	30	34
SEARIVER BENICIA	28	12
SEARIVER CHARLESTOWN	13	16
SEARIVER LONG BEACH	35	
SEARIVER MEDITERRANEAN	25	
SEARIVER NEW ORLEANS	9	
SEARIVER NORTH SLOPE	20	
SEARIVER PHILADELPHIA	8	6
SEARIVER SAN FRANCISCO	22	29
SEAWARD JOHNSON	27	29
SEDCO/BP 471	150	
SENATOR	119	
SENSATION	38	81
SGT WILLIAM A BUTTON	36	
SHELDON LYKES	84	170
SHELLY BAY	68	117
SHENAHON	2	1
SHIRAOI MARU	113	32
SIDNEY STAR	210	
SINBAD	29	
SINCERE GEMINI	6	
SKANDERBORG		37
SKAUBRYN	130	
SKAUGRAN	177	123
SKAUKAR	33	26
SKODSBORG	12	24
SKOGAFOSS	50	
SN	17	
SOKOLICA	31	19
SOL DO BRASIL	1	
SOLAR WING	92	86
SONORA	68	76
SOREN TOUBRO	6	
SOUTHERN PRINCESS		240
ST BLAIZE	96	
ST. CLAIR	16	
ST. LUCIA	38	
STAFFORDSHIRE	161	
STAR ALABAMA	30	40
STAR AMERICA	42	135
STAR DRIVANGER	124	
STAR DROTTANGER	156	
STAR EAGLE	94	115
STAR EVVIVA	89	119
STAR FLORIDA	121	104
STAR FRASER	83	
STAR FUJI	50	
STAR GEIRANGER	21	24
STAR GRAN	45	143
STAR MERIT	1	
STAR SKARVEN	21	
STAR SKOGANGER	38	135
STAR STRONEN	28	
STAR WILMINGTON	38	
STARSHIP MAJESTIC	9	36
STELLA LYKES	30	20
STELLAR BENY	121	
STELLAR VENUS	10	
STENA TRANSFER	180	255
STEWART J. CORT	474	518
STOLT CONDOR	11	
STONEWALL JACKSON	38	35
STRIDER ISIS	9	
STRONG ICELANDER	20	70
STRONG VIRGINIAN	5	1
SUE LYKES	37	42
SUGAR ISLANDER	27	
SUN VIKING		12
SUNBELT DIXIE	81	123
SUNRISE	5	
SUNRISE RUBY	81	
SWIFTNES	44	
SYNNOVE KNUSTEN	83	77
TABASCO	153	72
TABUK	59	
TAI HE	95	
TAI SHING	52	24
TAMAMONTA	28	
TAMPA	37	
TAMPA BAY	20	16
TARKWA	1	
THOMAS G. THOMPSON	140	91
THOMPSON LYKES	64	54
THOMPSON PASS	2	
TILLIE LYKES	44	128
TOKYO HIGHWAY	79	
TOLUCA	143	72
TONSINA	36	127
TORM FREYA	66	
TOWER BRIDGE	61	
TRANSWORLD BRIDGE	159	79
TRICORD SUCCESS	1	
TRITON	184	239
TROPIC DAY	63	161
TROPIC FLYER	2	109
TROPIC ISLE		8
TROPIC JADE	57	156
TROPIC KEY	74	179
TROPIC LURE		71
TROPIC MIST		74
TROPIC NIGHT		105
TROPIC OPAL		34
TROPIC REIGN	8	104
TROPIC SUN	64	99
TROPIC TIDE	21	60
TROPICAL BEAUTY		74
TROPICALE	24	27
TRUSKAVETS	42	
TSL BOLD		189
TULSIDAS	36	
TYSON LYKES	42	56
UCHOA	77	177
ULLSWATER	219	
ULTRAMAX	32	62
ULTRASEA	50	105
UNIVERSE	23	
USCGC ACACIA (WLB406)	11	
USCGC ACTIVE WMEC 618	32	
USCGC ACUSHNET WMEC 16	24	
USCGC BASSWOOD (WLB 38	40	
USCGC BEAR (WEMC 901)	15	
USCGC BISCAYNE BAY	1	10
USCGC BOUTWELL WHEC 71	37	
USCGC BRAMBLE (WLB 392	14	
USCGC CAMPBELL	76	
USCGC CHASE (WHEC 718)	21	26
USCGC CITRUS (WMEC 300	42	31
USCGC CONFIDENCE WMEC6	72	68
USCGC COURAGEOUS	13	16
USCGC DECISIVE WMEC 62	24	
USCGC DEPENDABLE	10	
USCGC DURABLE (WMEC 62	42	
USCGC FIREBUSH WLB 393	6	
USCGC FORWARD	88	
USCGC GALLATIN	48	
USCGC GALVESTON ISLAND	5	
USCGC HAMILTON WHEC 71	17	
USCGC HARRIET LANE	15	
USCGC IRONWOOD (WLB 29	13	
USCGC JARVIS (WHEC 725	69	
USCGC LAUREL (WLB 291)	18	
USCGC LEGARE	42	
USCGC MACKINAW	14	6
USCGC MALLOW (WLB 396)	54	21
USCGC MELLON (WHEC 717	15	
USCGC MOHAWK WMEC 913	98	24
USCGC MORGENTHAU	101	
USCGC NORTHLAND WMEC 9	56	1
USCGC PLANETREE	28	
USCGC POLAR SEA__(WAGB	223	
USCGC POLAR STAR (WAGB	76	81
USCGC RELIANCE WMEC 61	5	
USCGC RUSH	186	
USCGC SASSAFRAS	2	
USCGC SENECA	72	
USCGC SPENCER	13	
USCGC STORIS (WMEC 38)	71	69
USCGC SUNDEW (WLB 404)	9	
USCGC SWEETBRIER WLB 4	3	
USCGC TAHOMA	55	
USCGC TAMPA WMEC 902	3	3
USCGC THETIS		46
USCGC VENTUROUS WMEC 6	1	
USCGC VIGILANT WMEC 61	6	
USCGC VIGOROUS WMEC 62	30	50
USCGC YOCONA (WMEC 168	50	
USNS ALGOL	80	
USNS ALTAIR	122	176
USNS ANTARES		17
USNS APACHE (T-ATF 172	38	
USNS CATAWBA T-ATF 168	5	7
USNS DENEBOLA	43	24
USNS GUADALUPE	23	
USNS GUS W. DARNELL	59	
USNS HAYES	15	
USNS HENRY J. KAISER		14
USNS JOHN LENTHALL		27
USNS JOHN MCDONNELL (T	10	
USNS KANAWHA T-AO 196		112
USNS KANE TAGS 27	3	
USNS LEROY GRUMMAN		101
USNS LITTLEHALES (T-AG	81	72
USNS MAURY	4	
USNS MOHAWK (T-ATF 170	70	65
USNS NARRAGANSETT	89	89
USNS NAVAJO_(TATF-169)	37	
USNS PECOS	61	
USNS POWHATAN TATF 166	1	
USNS REGULUS	28	
USNS SEALIFT ANTARCTIC	20	17
USNS SEALIFT ARABIAN S	54	
USNS SEALIFT ARCTIC	92	72
USNS SEALIFT ATLANTIC	207	69
USNS SEALIFT CHINA SEA	42	
USNS SEALIFT INDIAN OC	14	34
USNS SEALIFT MEDITERRA	127	53
USNS SILAS BENT T-AGS		39
USNS SIOUX	79	96
USNS VANGUARD TAG 194	94	69
USNS WALTER S. DIEHL		40
USNS WILKES T-AGS-33	102	63
VEGA	176	
VELMA LYKES	53	
VENUS DIAMOND	140	
VERA ACORDE	31	
VINA DEL MAR	8	
VINE	154	
VIRGINIA	42	55
VISHVA SHAKTI	4	
VIVA	32	61
WASHINGTON HIGHWAY	44	
WEST MOOR	157	
WESTWARD	56	69
WESTWARD VENTURE	139	154
WESTWOOD ANETTE	69	138
WESTWOOD BELINDA	34	35
WESTWOOD CLEO	143	59
WESTWOOD JAGO	145	52
WESTWOOD MARIANNE	47	171
WILFRED SYKES	216	260
WOLVERINE	27	31
WORLD WING #2	98	205
YAMANAKA MARU	108	
YANKEE CLIPPER	16	
YOUNG SATO	31	
YOUNG SPROUT	69	43
ZETLAND	152	
ZIM AMERICA	84	
ZIM CANADA	49	
ZIM HOUSTON	8	
ZIM IBERIA	119	
ZIM KEELUNG	78	
ZIM MARSEILLES	1	
ZIM MIAMI	9	
ZIM SAVANNAH	39	

SUMMARY:

GRAND TOTAL VIA RADIO	69196	
GRAND TOTAL VIA MAIL	48582	
TOTAL UNIQUE OBS	90194	
TOTAL DUPLICATES	27584	(30.6%)
UNIQUE RADIO OBS.	41612	(46.1%)
UNIQUE MAIL OBS.	20998	(23.3%)

January, February and March 1994

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
BOAB	72	72	0	TAI HE
CBVM	32	32	0	VINA DEL MAR
CGDV	118	9	109	W. TEMPLEMAN
CG2676	14	4	10	SHAMOOK
CG2680	54	54	0	MARINUS
CG2965	18	1	17	TULLY
CWBP	10	10	0	*****
CZDO	60	60	0	QUEST
C6JY6	118	180	0	MELBOURNE STAR
C6JZ2	24	24	0	AMERICA STAR
C6KF8	2	2	0	****
DAKE	37	37	0	KOELN EXPRESS
DBFP	25	25	0	WALTHER HERWIG
DBLK	68	68	0	POLARSTERN
DD8436	62	62	0	FEHMARNBELT
DHCM	64	64	0	COLUMBUS CALIFORNIA
DHCW	52	52	0	COLUMBUS WELLINGTON
DIDA	29	29	0	ARIANA
D5BC	53	53	0	SEDCO BP/471
D5ND	124	124	0	SAINT LUCIA
D5NE	94	94	0	MT CABRITE
D5NZ	100	100	0	POLYNESIA
ELAX2	45	45	0	MICRONESIAN PRIDE
ELDM8	8	8	0	SEA ISLAND
ELHL6	23	23	0	*******
ELIL9	41	41	0	T A NAVIGATOR
ELIS8	71	71	0	T A MARINER
ELOF6	29	29	0	LONGAVI
ELXM6	1	1	0	***
ENDU	1	1	0	**
FASU	1	1	0	***
FHZI	189	189	0	LUASTROLABE
FNDH	47	47	0	***
FNDK	33	33	0	PATRICIA DELMAS
FNJT	1	1	0	KORRIGAN
FNOM	25	25	0	***
FNQC	31	31	0	RENEE DELMAS
FNQM	8	8	0	SUZANNE DELMAS
FNWC	47	47	0	NATHALIE DELMAS
FNXM	1	1	0	***
FNXN	12	12	0	SAINT ROMAIN
FNXW	13	13	0	SAINT ROCH
FNZP	29	29	0	RACINE
FNZQ	71	71	0	RIMBAUD
FPY0	3	3	0	***
GACA	129	129	0	CUMULUS
GLNE	29	29	0	**
GTHZ	4	4	0	**
GXRH	158	158	0	**
GYRW	34	34	0	**
GYSA	12	12	0	**
GYSE	10	10	0	**
HPAN	3	3	0	MICRONESIAN COMMERCE
HPEW	117	117	0	PACIFIC ISLANDER
H9BQ	77	77	0	MICRONESIAN INDEPEN-
DENCE				
JBOA	11	11	0	KEIFU MARU

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
JCCX	72	72	0	CHOFU MARU
JDWX	50	50	0	KOFU MARU
JFDG	60	60	0	SHUMPU MARU
JFPQ	62	62	0	KASHIMASAN MARU
JGZK	95	95	0	RYOFU MARU
JITV	127	127	0	WELLINGTON MARU
JIVB	53	53	0	SEIFU MARU
JKCF	29	29	0	***
JNZL	162	162	0	***
JRBM	17	17	0	***
JRPG	11	11	0	***
JSVY	2	2	0	***
J8JA4	17	17	0	***
KGJB	15	15	0	SEALAND DEFENDER
KIRH	31	31	0	SEALAND TRADER
KJLV	75	75	0	***
KNFG	117	117	0	SEA WOLF
KRGB	52	52	0	SEALAND ENTERPRISE
LADB2	55	55	0	SKAUGRAN
LAJV4	61	61	0	SKAUBRYN
NAVO	186	186	0	***
NAVOC	16	16	0	***
NAVOCE	110	110	0	***
NAVPAC	4	4	0	***
NCSG	8	8	0	***
NIDK	15	15	0	***
NIKA	1	1	0	***
NNJB	10	10	0	***
NNUD	1092	1092	0	SILAS BENT
NRUO	89	89	0	POLAR SEA
OWUO6	84	84	0	MOANA PACIFIC
PGEC	48	48	0	NEDLLOYD VAN NOORT
PGFE	42	42	0	***
PJJU	61	61	0	OLEANDER
P3LK3	23	23	0	SAINT GEORGES
SCOU	1	1	0	***
SCPL	1	1	0	***
SEXQ	1	1	0	***
SHIP	1032	1032	0	***
SJIB	1	1	0	***
SKVP	4	4	0	TV 284
SMZQ	1	1	0	TV 102
S6FK	172	172	0	SWAN REEFER
TFRD	1	1	0	***
TFVD	19	19	0	***
VGWW	15	15	0	***
VJBQ	49	49	0	ANRO AUSTRALIA
VJDI	21	21	0	IRON NEWCASTLE
VJDP	88	88	0	IRON PACIFIC
VKCN	57	57	0	CANBERRA
VKCV	36	36	0	DERWENT
VKLA	1	1	0	ADELAIDE
VKLP	16	16	0	HMAS MELBOURNE
VKMK	23	23	0	SWAN
VKML	25	25	0	SYDNEY
VKPT	35	35	0	PERTH
VLNB	41	41	0	TORRENS

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CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
VLNC	30	30	0	***
VSBI3	109	109	0	BIBI
VY3574	49	49	0	***
V2QT	64	64	0	***
WPGK	93	93	0	SEALAND NAVIGATOR
WPKD	114	114	0	SEALAND ACHIEVER
WSRL	76	76	0	SEALAND PACIFIC
WTDM	9	9	0	***
WTES	79	79	0	SURVEYOR
WTEA	49	0	49	DISCOVERER
XCSH	30	30	0	***
YDLR	68	68	0	BOGASARI LIMA
Y3CW	16	0	16	A. V. HUMBOLDT
ZCAQ9	240	240	0	WEST MOOR
ZCUC	1	1	0	***
ZCKP	22	22	0	STAR DRIVANGER
ZCKU	27	27	0	STAR DROTTANGER
ZDAZ6	73	73	0	T A EXPLORER
3EET4	35	35	0	***
3EGR6	46	46	0	RECIFE
3EHT6	38	38	0	KARINA BONITA
7JWN	40	40	0	***
7KDD	21	21	0	***
9VBZ	7	7	0	MAHSURI
9VUU	21	21	0	ANRO ASIA
9VVB	78	78	0	GOLDENSARI INDAH
9VWM	24	24	0	NEW ZEALAND STAR
21002	661	661	0	BUOY
21004	670	670	0	BUOY
22001	667	667	0	BUOY
23001	14	14	0	BUOY
32315	34	34	0	BUOY
32316	59	59	0	BUOY
32317	70	70	0	BUOY
32318	56	56	0	BUOY
32319	69	69	0	BUOY
32321	33	33	0	BUOY
32322	76	76	0	BUOY
35045	2	2	0	BUOY
43001	73	73	0	BUOY
51006	83	83	0	BUOY
51007	81	81	0	BUOY
51009	79	79	0	BUOY
51010	59	59	0	BUOY
51011	64	64	0	BUOY
51014	80	80	0	BUOY
51015	85	85	0	BUOY
51016	67	67	0	BUOY
51017	66	66	0	BUOY
51018	80	80	0	BUOY
51019	72	72	0	BUOY
51021	77	77	0	BUOY
51022	82	82	0	BUOY
51023	77	77	0	BUOY
51302	79	79	0	BUOY
51303	64	64	0	BUOY
51304	76	76	0	BUOY

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
51305	65	65	0	BUOY
51306	60	60	0	BUOY
51307	57	57	0	BUOY
51308	61	61	0	BUOY
51309	80	80	0	BUOY
51310	57	57	0	BUOY
52001	53	53	0	BUOY
52002	56	56	0	BUOY
52003	57	57	0	BUOY
52004	39	39	0	BUOY
52006	76	76	0	BUOY
52007	55	55	0	BUOY
52008	75	75	0	BUOY
52010	67	67	0	BUOY
52011	4	4	0	BUOY
52012	3	3	0	BUOY
52301	35	35	0	BUOY
52302	53	53	0	BUOY
52306	62	62	0	BUOY
52307	78	78	0	BUOY
52309	77	77	0	BUOY
52310	58	58	0	BUOY
52311	53	53	0	BUOY
52312	57	57	0	BUOY
52313	55	55	0	BUOY
52314	25	25	0	BUOY
52315	8	8	0	BUOY
52316	66	66	0	BUOY

TOTAL BATHYS RECEIVED 13764

TOTAL TESACS RECEIVED 723

TOTAL REPORTS RECEIVED 14487

January, February and March 1994

Wave observations are taken each hour during a 20-minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one-third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most stations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0-minute averaging period each hour (moored buoys) and a 2.0-minute averaging period for fixed stations (C-MAN). Contact NDBC Data Systems Division, Bldg 1100, SSC, Mississippi 39529 or phone (601) 688-2838 for more details.

BUOY CLIMATOLOGICAL DATA SUMMARY

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
JANUARY		**1994**											
32302	18.0S	085.1W	0744	20.3	20.8	1.7	3.4	31/03	11.2	E	21.0	25/06	1014.0
41001	34.7N	072.7W	0743	14.7	19.1	2.7	9.3	04/18	16.5	NW	36.1	04/17	1020.7
41002	32.3N	075.2W	0742	16.6	20.5	2.4	8.7	04/14	16.0	S	35.6	04/11	1021.0
41004	32.5N	079.1W	0739	14.5	15.1	1.6	4.6	04/06	14.8	SW	38.1	04/08	1020.9
41006	29.3N	077.4W	0695	19.5	22.8	2.2	5.3	04/08	15.8	E	33.8	04/06	1021.0
41009	28.5N	080.2W	1486	19.2	22.3	1.5	3.3	11/02	15.6	E	36.7	04/04	1020.5
41010	28.9N	078.5W	1487	19.9	23.1	2.2	5.7	04/08	15.8	E	35.4	04/06	1020.9
41016	24.6N	076.5W	0742	23.4	25.4	0.8	2.1	12/04	16.5	NE	29.0	19/21	1020.4
42001	25.9N	089.7W	0744	20.1	21.7	1.8	5.7	04/01	15.4	NE	33.4	04/23	1020.1
42002	25.9N	093.6W	0744	20.5	23.5	2.0	4.8	08/03	17.8	SE	34.4	08/02	1019.4
42003	25.9N	085.9W	0743	21.7	25.9	1.8	5.6	04/02	17.2	E	37.5	03/22	1020.4
42007	30.1N	088.8W	0744	10.0	12.9				14.4	NE	34.0	03/20	1022.0
42016	29.9N	088.0W	0743	11.9	15.4				13.9	N	33.4	03/21	1021.7
42019	27.9N	095.0W	0742	18.7	21.1	1.7	3.2	21/15	15.7	SE	32.4	03/09	1020.0
42020	27.0N	096.5W	0743	18.8	20.9	1.8	3.9	07/19	15.2	SE	34.6	03/10	1019.5
42025	25.0N	080.5W	0743	22.2	24.0	0.9	2.4	17/05					
42035	29.3N	094.4W	0743	12.5	13.7	1.1	2.8	10/04	13.6	E	29.9	03/14	1021.1
42036	28.5N	084.5W	0742	16.0	18.2	1.3	6.9	04/02	14.2	NE	33.6	04/01	1020.5
44004	38.5N	070.7W	0743	7.2	14.2	2.9	8.9	04/20	17.6	NW	35.2	28/21	1020.0
44005	42.7N	068.6W	0298	0.3	6.4	2.7	7.1	04/17	19.7	W	37.3	06/04	1016.9
44007	43.5N	070.1W	0193	-5.7	5.0	1.5	5.6	04/20	18.4	NE	33.8	04/15	1015.4
44008	40.5N	069.4W	0741	1.3	5.8	2.5	7.3	05/04	18.7	NW	40.4	04/13	1019.6
44009	38.5N	074.7W	0740	1.2	5.5				15.0	NW	32.4	15/07	1022.3
44011	41.1N	066.6W	0486	1.5	5.7	2.9	7.9	18/13	16.3	W	30.5	16/11	1019.8
44013	42.4N	070.7W	0740	-3.9	3.5	1.1	5.8	04/17	16.1	W	34.2	06/01	1019.6
44014	36.6N	074.8W	0227	11.0	14.2	2.5	5.0	04/15	18.5	N	26.2	28/20	1017.2
44025	40.3N	073.2W	0742	-0.4	4.9	1.7	5.9	04/13	16.9	W	40.2	04/12	1020.8
46002	42.5N	130.3W	0737	10.9	11.2	3.0	7.3	08/17	12.2	SW	30.3	25/00	1019.7
46003	51.9N	155.9W	0741	4.5	5.0	3.3	6.5	25/15	15.3	NE	33.0	22/17	1000.8
46005	46.1N	131.0W	0743	10.4	11.1	3.1	6.6	22/04	13.4	S	32.4	24/11	1017.9
46006	40.9N	137.5W	0736	12.5	13.5	3.5	10.1	24/05	16.2	S	36.7	24/05	1018.9
46012	37.4N	122.7W	0737	12.4	13.0	2.1	4.8	25/06	9.8	NW	29.0	24/10	1021.4
46013	38.2N	123.3W	0739	11.6	12.5	2.3	5.1	25/20	10.2	N	28.6	24/07	1020.9
46014	39.2N	124.0W	0738	11.2	12.2	2.4	5.1	25/02	10.2	N	32.4	24/03	1021.4
46025	33.8N	119.1W	0629	14.7	15.0				6.2	NW	20.8	25/11	1020.3
46026	37.8N	122.7W	0735	11.4	11.8	1.7	4.5	25/05	10.5	NE	26.8	24/06	1021.7
46027	41.9N	124.4W	0734	10.8	11.2	2.5	5.5	09/08	10.5	S	32.6	24/02	1020.8
46029	46.2N	124.2W	0740	10.0	9.1	2.6	5.3	01/07	11.5	S	31.8	01/02	1020.6
46030	40.4N	124.5W	0742	10.8	11.9	2.3	5.7	25/02	12.6	N	32.6	23/23	1020.8
46035	57.0N	177.7W	0742	-0.6	3.0	3.3	11.3	21/11	18.8	NE	48.4	21/10	1005.8
46041	47.4N	124.5W	0738	8.3	8.8	2.4	4.4	02/23	9.5	SE	27.6	01/01	1020.0
46042	36.8N	122.4W	0733	12.3		2.2	5.0	25/11	9.6	NW	23.7	05/23	1021.5
46045	33.8N	118.5W	0741	14.3	14.9	1.0	2.4	26/01	5.4	W	20.8	25/12	1019.0
46051	34.5N	120.7W	0732	13.5	14.4				11.3	NW	27.4	05/23	1020.5
46053	34.2N	119.9W	0744	14.3	14.8	1.3	2.7	05/22	7.5	W	27.6	05/21	1019.2
46054	34.3N	120.5W	0743	13.8	14.3	1.8	4.3	25/15	12.1	NW	35.2	05/23	1020.2
51001	23.4N	162.3W	0743	21.3	22.8	3.3	6.8	30/23	14.1	NE	26.9	20/10	1017.6
51002	17.2N	157.8W	0742	24.1	24.9	2.6	4.5	24/23	14.0	E	26.7	24/07	1014.4
51003	19.1N	160.8W	0742	23.5	25.0	2.8	5.1	29/11	12.6	NE	26.9	24/05	1014.4
51004	17.4N	152.5W	0743	24.0	25.3	2.4	4.5	03/20	13.9	NE	25.1	22/17	1015.5
51026	21.4N	157.0W	0737	22.1	23.7	2.8	5.6	29/05	12.7	E	26.6	20/13	1016.0
52009	13.7N	144.7E	0711			1.9	3.4	26/07	13.1	NE	22.2	24/23	1009.8
91222	18.1N	145.8E	0688	25.5					6.1	NE	17.3	13/23	1012.4
91251	11.4N	162.4E	0590	26.9					16.6	E	29.3	28/06	1010.4
91328	8.6N	149.7E	0736	27.2					8.8	NE	17.4	28/13	1009.3
91338	5.3N	153.7E	0736	27.6					7.0	NE	26.0	21/17	1007.4
91343	7.6N	155.2E	0736	27.7					13.4	NE	27.7	01/12	1007.9
91352	6.2N	160.7E	0737	27.5					12.1	NE	22.8	24/15	1008.7
91355	5.4N	163.0E	0737	27.6					9.0	NE	24.6	28/01	1007.2
91377	6.1N	172.1E	0741	27.4					11.3	NE	24.6	03/17	1009.5
ABAN6	44.3N	075.9W	0732	-14.1	18.4				5.7	N	22.8	26/10	1022.7
ALSN6	40.5N	073.8W	0740	-2.8	4.1	1.1	4.8	04/16	17.7	NW	42.7	28/18	1022.4
BURL1	28.9N	089.4W	0735	11.8					16.3	NE	38.8	03/18	1021.6

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
BUSL1	27.9N	090.9W	0744		21.7				16.5	NE	33.3	03/18	
BUZM3	41.4N	071.0W	0201	-0.4					20.2	W	39.1	04/10	1013.9
CARO3	43.3N	124.4W	0739	9.4					10.3	S	31.3	08/21	1020.6
CHLV2	36.9N	075.7W	0742	2.9					16.1	N	37.4	28/17	1022.5
CLKN7	34.6N	076.5W	0742	7.2					13.0	N	30.8	04/12	1022.4
CSBF1	29.7N	085.4W	0736	10.5					7.1	N	33.6	04/01	1021.6
DBLN6	42.5N	079.4W	0743	-7.3					16.4	SW	41.9	29/01	1021.4
DESW1	47.7N	124.5W	0742	8.0					11.5	SE	40.8	01/02	1020.0
DISW3	47.1N	090.7W	0743	-13.8					15.1	W	37.7	08/01	1023.0
DPIA1	30.3N	088.1W	0733	9.2	10.2				12.8	N	28.8	16/22	1021.9
DRYF1	24.6N	082.9W	0743	20.5					14.1	NE	33.0	14/03	1019.7
DSLN7	35.2N	075.3W	0742	9.0	14.9	1.9	5.3	04/14	20.4	N	50.5	04/12	1022.2
FBIS1	32.7N	079.9W	0674	8.6					8.6	NE	27.7	28/18	1021.1
FFIA2	57.3N	133.6W	0744	1.2					16.5	N	36.2	06/14	1013.5
FPSN7	33.5N	077.6W	0641	10.8		1.7	5.7	04/10	19.0	W	52.1	04/11	1021.9
FWYF1	25.6N	080.1W	0744	21.7	23.6				17.8	E	37.3	03/20	1020.2
GDIL1	29.3N	090.0W	0741	11.5	13.2				12.8	NE	31.5	03/21	1021.7
GLLN6	43.9N	076.5W	0743	-11.4					15.6	NE	35.0	29/02	1020.8
IOSN3	43.0N	070.6W	0743	-6.2	.				17.8	W	53.1	04/16	1019.0
LKWF1	26.6N	080.0W	0742	20.5	23.0				14.6	NE	29.6	10/21	1020.7
LONF1	24.9N	080.9W	0742	20.6	20.6				12.3	NE	26.9	19/20	1019.7
MISM1	43.8N	068.9W	0743	-6.0					19.1	W	49.8	04/17	1018.4
MLRF1	25.0N	080.4W	0743	22.1	23.6				16.1	E	29.2	04/07	1019.2
NWPO3	44.6N	124.1W	0742	8.8					10.3	E	38.8	04/14	1021.6
PILM4	48.2N	088.4W	0697	-15.9					16.2	N	39.0	11/05	1023.9
PTAC1	39.0N	123.7W	0741	10.3					8.7	S	30.8	24/05	1021.6
PTAT2	27.8N	097.1W	0647	14.2	14.2				12.8	N	29.3	28/16	1020.3
PTGC1	34.6N	120.7W	0740	13.0					11.2	N	37.5	06/00	1019.6
ROAM4	47.9N	089.3W	0739	-16.0					17.2	N	40.9	21/04	1024.0
SANF1	24.5N	081.9W	0625	20.6	23.0				16.3	NE	31.3	17/01	1020.0
SAUF1	29.9N	081.3W	0743	12.6	13.0				11.0	N	30.1	09/21	1021.9
SBIO1	41.6N	082.8W	0445	-8.4					14.2	SW	30.4	05/08	1021.8
SGNM3	43.8N	087.7W	0722	-11.0	0.4				13.2	W	29.8	10/16	1023.7
SISW1	48.3N	122.9W	0743	7.9					10.4	SE	37.2	01/04	1020.1
SMKF1	24.6N	081.1W	0743	21.5	23.1				16.5	NE	34.1	14/05	1019.9
SPGF1	26.7N	079.0W	0743	20.8	23.5				10.5	E	25.5	14/11	1021.0
SRST2	29.7N	094.1W	0723	10.3					10.7	E	30.5	27/18	1021.6
STDM4	47.2N	087.2W	0743	-11.7					20.3	NW	43.3	10/16	
SUPN6	44.5N	075.8W	0737	-14.3	1.8				10.3	NE	34.1	29/04	1021.6
SVLS1	32.0N	080.7W	0700	8.9	9.8	0.9	2.1	18/02	14.7	NE	37.2	04/10	1022.1
THIN6	44.3N	076.0W	0742	-13.7									
TPLM2	38.9N	076.4W	0720	-2.0	5.5				11.5	N	33.0	15/06	1022.9
TTIW1	48.4N	124.7W	0743	8.2					13.9	S	39.5	20/08	1019.9
VENF1	27.1N	082.5W	0740	16.0	16.0				9.7	NE	29.6	04/05	1021.2
WPOW1	47.7N	122.4W	0742	8.0					8.1	S	28.3	04/20	1020.8
FEBRUARY		**1994**											
32302	18.0S	085.1W	0651	20.9	21.5	2.1	3.1	01/02	14.4	SE	22.3	16/18	1013.6
41001	34.7N	072.7W	0656	15.0	18.1	2.3	4.6	24/21	15.0	NW	28.0	24/16	1021.4
41002	32.3N	075.2W	0656	17.6	20.5	2.0	4.4	19/21	15.1	E	27.0	14/08	1021.6
41004	32.5N	079.1W	0653		14.7	1.5	4.3	19/08					1021.1
41006	29.3N	077.4W	0562	20.8	22.6	2.0	6.2	19/12	13.7	E	29.0	18/14	1020.3
41009	28.5N	080.2W	1313	20.7	22.9	1.4	6.0	19/04	14.1	E	32.3	19/00	1020.2
41010	28.9N	078.5W	1314	20.6	22.5	1.8	6.1	19/04	13.2	E	31.1	18/16	1020.8
41016	24.6N	076.5W	0657	24.1	25.1	0.6	1.7	18/04	12.1	E	26.8	17/19	1019.7
42001	25.9N	089.7W	0657	21.1	22.5	1.4	3.5	14/08	14.1	NE	30.1	02/08	1019.1
42002	25.9N	093.6W	0657	20.4	22.7	1.5	4.4	24/02	15.2	SE	32.1	23/22	1018.3
42003	25.9N	085.9W	0658	22.9	25.9	1.3	3.3	14/19	14.1	NE	29.5	02/12	1019.6
42007	30.1N	088.8W	0647	12.9	14.0				10.9	NE	30.3	11/09	1020.9
42016	29.9N	088.0W	0655	14.1	15.7				10.2	N	25.8	23/22	1020.9
42019	27.9N	095.0W	0655	17.3	20.1	1.3	3.2	13/17	12.4	SE	30.3	23/14	1018.9
42020	27.0N	096.5W	0656	18.1	20.0	1.5	4.0	13/13	13.5	SE	31.9	13/09	1018.3
42025	25.0N	080.5W	0656	23.4	25.0	0.6	2.3	17/15					
42035	29.3N	094.4W	0655	12.9	14.2	0.8	1.7	13/09	10.6	E	27.4	13/09	1020.0
42036	28.5N	084.5W	0649	17.6	18.8	0.9	2.9	14/09	12.0	NE	25.5	14/03	1020.0
44004	38.5N	070.7W	0657	8.2	13.4	2.5	6.7	14/22	16.1	NW	36.5	14/21	1020.1
44007	43.5N	070.1W	0540	-4.4	1.6	1.0	5.5	24/16	14.5	N	27.8	24/14	1020.1
44008	40.5N	069.4W	0657	1.8	4.4	2.1	5.0	12/07	17.2	NW	36.3	04/00	1019.5
44009	38.5N	074.7W	0653	2.3	3.3				12.3	NW	29.1	26/17	1022.5
44011	41.1N	066.6W	0656	2.5	5.3	2.6	6.1	25/15	16.8	W	36.5	12/08	1017.8
44013	42.4N	070.7W	0655	-2.5	1.5	1.0	4.4	09/15	15.1	NW	31.3	26/22	1019.5
44014	36.6N	074.8W	0641	6.8	7.7	1.3	2.9	10/10	11.7	NW	28.6	14/06	1022.3
44025	40.3N	073.2W	0655	0.3	3.1	1.4	4.4	23/20	15.2	W	31.5	23/20	1021.0
46002	42.5N	130.3W	0648	9.5	10.6	3.2	6.5	14/07	13.9	SW	28.6	10/16	1014.5
46003	51.9N	155.9W	0649	3.6	4.6	3.9	8.3	24/11	19.5	SW	26.0	01/18	1007.6
46005	46.1N	131.0W	0648	8.3	10.2	3.3	7.5	12/23	14.6	W	32.1	12/19	1012.1
46006	40.9N	137.5W	0653	10.8	12.3	3.4	6.0	14/07	16.6	NW	31.5	06/00	
46012	37.4N	122.7W	0649	11.6	12.8	2.3	5.5	17/07	11.6	NW	37.5	17/07	1017.6
46013	38.2N	123.3W	0651	11.1	12.4	2.4	6.1	17/09	12.2	N	33.8	17/08	1016.8

January, February and March 1994

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
46014	39.2N	124.0W	0648	10.5	12.0	2.5	5.7	17/07	10.8	NW	39.4	17/04	1017.2
46025	33.8N	119.1W	0631	13.8	14.3	1.1	3.2	18/15	9.1	NW	25.1	04/12	1017.3
46026	37.8N	122.7W	0652	10.9	12.0	1.8	4.3	17/07	11.7	NW	42.0	17/07	1017.7
46027	41.9N	124.4W	0645	9.5	10.8	2.5	4.8	13/23	11.7	S	30.5	16/13	1015.8
46029	46.2N	124.2W	0647	8.4	8.5	2.7	7.1	13/08	13.8	S	33.1	13/05	1013.5
46030	40.4N	124.5W	0655	9.9	10.2	2.2	5.9	17/07	11.9	SE	39.8	16/22	1016.3
46035	57.0N	177.7W	0655	0.7	2.5	4.0	7.7	24/16	20.4	NE	34.8	24/07	1007.9
46041	47.4N	124.5W	0645	6.5	8.3	2.6	6.8	13/04	12.5	SE	33.4	13/04	1012.5
46042	36.8N	122.4W	0646	11.6		2.4	5.0	17/08	12.0	NW	33.8	17/08	1018.1
46045	33.8N	118.5W	0633	13.4	14.3	1.1	2.8	08/13	7.7	W	24.3	11/16	1017.2
46051	34.5N	120.7W	0646	12.8	13.4				12.8	NW	32.3	04/05	1017.9
46053	34.2N	119.9W	0658	13.4	13.9	1.2	2.8	18/13	11.1	W	34.0	04/07	1017.0
46054	34.3N	120.5W	0654	13.0	13.6	2.1	4.4	08/21	14.1	NW	38.3	04/04	1017.9
51001	23.4N	162.3W	0654	22.1	23.1	2.6	4.4	23/03	12.0	E	26.7	12/20	1015.7
51002	17.2N	157.8W	0653	24.3	24.8	2.4	3.9	07/08	13.9	E	28.8	16/13	1013.6
51003	19.1N	160.8W	0654	23.5	24.6	2.3	4.1	01/02	10.8	E	22.4	12/13	1013.4
51004	17.4N	152.5W	0655	24.1	24.8	2.4	4.0	07/05	13.8	NE	26.8	07/01	1014.9
51026	21.4N	157.0W	0648	22.3	23.0	2.3	4.6	01/00	13.3	E	24.5	07/18	1015.1
52009	13.7N	144.7E	0598			1.9	3.2	11/20	13.2	NE	21.0	19/01	1010.2
91222	18.1N	145.8E	0600	24.9					5.5	NE	16.7	20/03	1012.5
91251	11.4N	162.4E	0487	26.7					14.9	E	24.4	09/14	1010.3
91328	8.6N	149.7E	0520	27.3					9.3	NE	21.0	04/21	1009.5
91338	5.3N	153.7E	0516	27.7					7.1	N	21.7	02/01	1007.4
91343	7.6N	155.2E	0517	27.5					13.2	NE	20.8	07/11	1008.0
91352	6.2N	160.7E	0519	27.4					11.8	NE	19.6	20/21	1009.1
91355	5.4N	163.0E	0514	27.4					8.4	NE	21.2	10/22	1007.4
91377	6.1N	172.1E	0652	27.2					10.2	NE	24.3	02/02	1009.6
ABAN6	44.3N	075.9W	0657	-9.6					4.8	S	19.9	09/13	1022.3
ALSN6	40.5N	073.8W	0644	-1.2	2.6	0.9	3.4	23/23	16.5	NW	39.9	23/19	1022.6
BURL1	28.9N	089.4W	0650	13.1					13.4	NE	29.8	23/22	1020.7
BUSL1	27.9N	090.9W	0656		21.4				13.7	NE	30.3	10/20	
BUZM3	41.4N	071.0W	0484	-1.7					15.7	SW	33.0	03/19	1021.5
CARO3	43.3N	124.4W	0653	7.9					10.4	S	35.0	21/09	1014.8
CHLV2	36.9N	075.7W	0649	4.8					14.5	N	31.2	26/15	1022.4
CLKN7	34.6N	076.5W	0656	10.5					11.5	NE	30.0	10/11	1022.8
CSBF1	29.7N	085.4W	0652	14.4					6.5	NE	21.8	11/11	1020.8
DBLN6	42.5N	079.4W	0656	-5.2					12.5	SW	39.6	24/15	1022.3
DESW1	47.7N	124.5W	0650	6.0					14.5	SE	44.5	13/04	1012.4
DISW3	47.1N	090.7W	0656	-11.4					12.7	SW	34.1	23/18	1020.8
DPIA1	30.3N	088.1W	0629	12.8	13.1				10.7	N	30.4	26/13	1021.4
DRYF1	24.6N	082.9W	0656	21.9					12.0	NE	28.4	02/18	1018.9
DSLN7	35.2N	075.3W	0656	11.2	15.7	1.7	4.2	24/14	17.8	N	43.9	24/13	1022.7
FBIS1	32.7N	079.9W	0642	10.9					7.4	NE	23.2	10/17	1022.3
FFIA2	57.3N	133.6W	0651	-2.9					21.2	N	44.1	15/08	1008.9
FPSN7	33.5N	077.6W	0580	13.7		1.6	3.8	24/11	17.4	N	44.9	24/09	1021.8
FWYF1	25.6N	080.1W	0657	22.9	24.5				12.8	E	35.6	19/05	1019.4
GDIL1	29.3N	090.0W	0652	14.2	15.7				10.3	NE	31.1	23/20	1020.6
GLLN6	43.9N	076.5W	0656	-8.2					14.2	NE	38.6	04/03	1021.0
IOSN3	43.0N	070.6W	0654	-3.9					16.7	NW	38.0	27/22	1019.0
LKWF1	26.6N	080.0W	0656	22.0	23.9				13.4	E	35.5	19/03	1020.0
LONF1	24.9N	080.9W	0655	22.7	23.6				11.4	NE	26.5	18/00	1018.8
MDRM1	44.0N	068.1W	0473	-4.1					19.1	NW	39.4	25/01	1017.9
MISM1	43.8N	068.9W	0656	-4.3					18.3	NW	43.2	24/17	1018.5
MLRF1	25.0N	080.4W	0657	23.2	24.7				12.8	E	29.1	18/04	1018.3
NWPO3	44.6N	124.1W	0650	7.4					11.7	S	42.9	13/14	1015.1
PILM4	48.2N	088.4W	0656	-12.0					14.3	NW	31.3	05/07	1021.7
PTAC1	39.0N	123.7W	0651	9.2					9.4	SE	37.5	17/07	1017.4
PTAT2	27.8N	097.1W	0613	13.7	13.9				11.2	N	29.3	13/07	1018.7
PTGC1	34.6N	120.7W	0605	12.1					12.4	N	35.1	17/12	1017.0
ROAM4	47.9N	089.3W	0656	-11.9					14.9	NE	36.9	23/18	1021.6
SANF1	24.5N	081.9W	0283	23.5	24.5				12.1	NE	28.1	17/19	1016.0
SAUF1	29.9N	081.3W	0657	15.3	13.8				10.1	N	32.2	14/08	1021.5
SBIO1	41.6N	082.8W	0213	-6.1					12.7	SW	25.3	03/19	1020.7
SGNW3	43.8N	087.7W	0656	-7.6					12.4	NW	35.4	26/02	1022.3
SISW1	48.3N	122.9W	0650	5.5					14.9	SE	46.0	13/03	1012.6
SMKF1	24.6N	081.1W	0656	23.2	24.6				14.0	E	29.1	15/00	1019.1
SPGF1	26.7N	079.0W	0656	21.9	24.1				9.2	E	30.3	18/21	1020.3
SRST2	29.7N	094.1W	0612	11.8					9.5	SE	20.7	13/18	1020.6
STDM4	47.2N	087.2W	0654	-10.7					18.4	NW	45.5	18/21	1021.8
SUPN6	44.5N	075.8W	0656	-9.9	14.1				9.2	SW	26.9	04/03	1021.3
SVLS1	32.0N	080.7W	0652	8.6	11.0	0.8	2.2	18/23	14.4	NE	34.9	24/07	1022.1
THIN6	44.3N	076.0W	0656	-9.6									
TPLM2	38.9N	076.4W	0628	1.2					10.4	S	29.8	23/18	1022.7
TTIW1	48.4N	124.7W	0649	5.6					17.3	E	48.9	13/03	1012.0
VENF1	27.1N	082.5W	0060	11.6	17.4				9.0	N	17.9	01/00	1023.7
WPOW1	47.7N	122.4W	0647	5.8					11.0	S	31.7	13/07	1013.7
MARCH		**1993**											
32302	18.0S	085.1W	0737	21.5	22.3	1.9	3.8	22/18	10.2	SE	19.2	26/03	1013.6
41001	34.7N	072.7W	0741	15.5	18.1	2.7	8.5	03/06	16.6	S	37.5	19/04	1014.8

January, February and March 1994

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA HR)	MEAN PRESS (MB)
41002	32.3N	075.2W	0743	18.1	20.0	2.3	7.7	03/15	16.2	SE	36.5	02 22	1015.5
41006	29.3N	077.3W	0744	20.8	22.6	2.0	6.5	03/09	15.0	E	33.6	02 21	1016.1
41009	28.5N	080.2W	1485	20.8	22.6	1.1	3.0	02/11	14.3	SE	34.0	02 16	1016.1
41010	28.9N	078.5W	1486	21.2	22.7	1.8	6.3	03/09	14.4	S	33.0	03 03	1016.5
41016	24.6N	076.5W	0743	23.7	25.0	0.5	1.8	03/19	11.3	SE	30.4	03 18	1017.5
42001	25.9N	089.7W	0740	21.2	22.2	1.2	3.9	02/21	11.9	SE	30.7	28 21	1016.8
42002	25.9N	093.6W	0738	20.8	22.1	1.4	4.3	02/15	13.9	SE	33.8	09 16	1015.8
42003	25.9N	085.9W	0742	23.2	25.8	1.2	4.8	03/04	13.3	SE	35.4	29 02	1017.2
42007	30.1N	088.8W	0744	16.0	17.1				12.4	SE	32.6	03 01	1016.7
42016	29.9N	088.0W	0552	16.0	16.7				10.9	E	28.0	03 00	1016.7
42019	27.9N	095.0W	0742	18.9	20.4	1.2	3.3	02/10	11.8	SE	33.6	09 11	1015.9
42020	27.0N	096.5W	0744	19.5	20.3	1.2	3.7	09/13	12.3	SE	31.3	02 07	1015.6
42025	25.0N	080.5W	0741	23.2	24.6	0.5	2.3	01/17					
42035	29.3N	094.4W	0744	16.5	17.1	0.7	2.0	09/13	10.8	SE	30.5	09 17	1016.7
42036	28.5N	084.5W	0730	19.2	19.4	1.1	5.0	03/00	11.6	SE	29.9	02 23	1016.1
42037	24.5N	081.4W	0097	24.3	24.6	0.8	1.7	28/07	10.3	SE	15.7	31 23	1016.5
44004	38.5N	070.7W	0739	10.2	13.1	2.8	9.0	03/10	16.9	NW	35.6	03 00	1012.4
44007	43.5N	070.1W	0738	1.1	1.7	1.1	5.3	04/03	11.8	N	31.7	22 23	1011.7
44008	40.5N	069.4W	0743	4.2	4.1	2.2	7.8	03/17					1011.6
44009	38.5N	074.7W	0740	4.9	4.1				13.1	NW	33.4	03 00	1014.1
44011	41.1N	066.6W	0743	4.7	4.7	2.9	8.7	03/23	14.3	NW	37.1	03 17	1010.7
44013	42.4N	070.7W	0743	1.9	2.1	1.0	5.0	04/01	11.7	NW	31.1	03 22	1011.0
44014	36.6N	074.8W	0742	7.9	7.3				12.6	S	30.7	02 22	1014.6
44025	40.3N	073.2W	0743	3.5	3.3	1.3	7.4	03/10	13.3	W	39.6	03 07	1012.3
45002	45.3N	086.4W	0053	-0.3	0.5	0.9	2.0	31/23	15.0	SW	22.2	31 21	1022.1
45007	42.8N	087.1W	0078	1.0	1.3	0.4	0.7	29/14	7.9	W	14.0	29 14	1021.7
46002	42.5N	130.3W	0730	9.8	10.7	3.3	7.6	21/07	14.1	S	31.9	20 23	1018.6
46003	51.9N	155.9W	0738	2.5	4.0	4.2	11.5	13 23					1002.7
46005	46.1N	131.0W	0738	8.5	9.8	3.5	8.9	21/04	14.5	N	42.9	21 00	1017.6
46006	40.9N	137.5W	0741	10.7	11.6	3.7	8.0	24/16	14.8	S	26.6	02 01	
46012	37.4N	122.7W	0732	12.1	13.1	2.2	4.6	24/22	10.4	NW	28.8	24 11	1018.7
46013	38.2N	123.3W	0722	11.6	12.4	2.5	5.0	22/17	11.8	N	29.1	19 15	1017.9
46014	39.2N	124.0W	0737	11.1	11.9	2.6	5.9	22/21	9.9	NW	31.5	23 20	1018.8
46022	40.8N	124.5W	0052	11.1	11.9	2.1	3.0	31/11	6.5	NW	15.3	31 22	1025.5
46025	33.8N	119.1W	0705	14.4	14.8	1.1	3.1	23/00	6.8	NW	29.7	23 01	1016.3
46026	37.8N	122.7W	0736	11.7	12.7	1.7	3.2	22/05	10.4	NW	25.5	11 04	1018.8
46027	41.9N	124.4W	0735	10.2	10.8	2.5	5.7	22/08	10.3	N	35.2	06 00	1018.5
46029	46.2N	124.2W	0730	10.2	9.4	2.8	7.7	21/11	12.8	S	33.1	21 05	1018.6
46030	40.4N	124.5W	0740	10.3		2.3	4.8	06/07	11.1	N	35.9	23 22	1018.6
46035	57.0N	177.7W	0744	-3.8	1.8	3.3	7.1	23/14	19.0	N	38.1	23 11	1007.2
46041	47.4N	124.5W	0732	8.3	9.6	2.6	7.3	21/08	10.9	S	39.1	21 07	1018.0
46042	36.8N	122.4W	0737	12.0		2.4	5.1	22/11	11.1	NW	29.5	24 15	1018.9
46045	33.8N	118.5W	0731	14.4	15.0	1.0	3.5	23/02	6.1	SW	27.6	23 00	1016.4
46050	44.6N	124.5W	0549	9.4	10.2	2.8	7.5	21/16	11.6	N	30.5	21 03	1016.6
46051	34.5N	120.7W	0739	12.9	13.1				12.7	NW	31.1	24 16	1017.7
46053	34.2N	119.9W	0743	13.8	14.2	1.2	2.4	22 22	9.3	W	31.3	23 00	1016.3
46054	34.3N	120.5W	0724	13.2	13.7	2.1	4.6	23/00	15.2	NW	31.5	22 16	1017.3
51001	23.4N	162.3W	0120	23.0	23.7	1.9	2.7	01/06	11.1	SW	18.1	05 23	1016.0
51002	17.2N	157.8W	0741	24.6	25.4	2.9	6.0	16 18	16.8	E	31.0	15 22	1015.5
51003	19.1N	160.8W	0744	23.5	24.9	2.8	6.1	16 16	14.6	NE	31.8	24 03	1015.9
51004	17.4N	152.5W	0741	24.0	25.1	2.8	5.5	16 18	16.8	NE	31.3	16 19	1016.7
51026	21.4N	157.0W	0742	22.4	23.6	2.8	6.0	16/11	16.2	E	31.9	15/08	1018.0
52009	13.7N	144.7E	0720			2.0	4.1	08/01	14.0	NE	21.8	29 01	1011.4
91222	18.1N	145.8E	0679	25.7					7.1	E	17.0	10 04	1014.1
91251	11.4N	162.4E	0679	27.1					17.6	NE	29.1	27 04	1010.5
91328	8.6N	149.7E	0676	27.6					9.7	NE	17.5	27 14	1010.6
91338	5.3N	153.7E	0675	27.8					6.7	NE	25.7	28 20	1008.5
91343	7.6N	155.2E	0669	27.6					13.8	NE	25.8	26 14	1009.1
91352	6.2N	160.7E	0684	27.6					13.0	NE	25.6	23 10	1010.0
91355	5.4N	163.0E	0681	27.4					8.4	NE	22.2	06 11	1008.3
91377	6.1N	172.1E	0741	27.1					11.4	NE	26.6	09 18	1010.6
ABAN6	44.3N	075.9W	0742	-1.6	1.3				3.3	S	16.0	03 21	1013.7
ALSN6	40.5N	073.8W	0718	3.7	3.0	0.9	6.0	03 11	16.7	NW	50.6	03 08	1013.8
BURL1	28.9N	089.4W	0738	15.8					12.2	SE	32.9	02 12	1017.1
BUSL1	27.9N	090.9W	0744		22.1				12.6	SE	30.6	09 17	
CARO3	43.3N	124.4W	0741	9.2					11.2	S	32.9	05 23	1018.5
CHLV2	36.9N	075.7W	0679	8.1	6.1	1.0	2.5	04/00	16.8	S	39.2	17 07	1014.3
CLKN7	34.6N	076.5W	0743	13.5					12.6	SW	37.1	02 18	1015.2
CSBF1	29.7N	085.4W	0739	16.8					8.1	NW	32.5	03 00	1016.5
DBLN6	42.5N	079.4W	0743	-0.6					11.2	SW	28.3	24 22	1015.1
DESW1	47.7N	124.5W	0739	8.1					12.8	SE	48.9	21 08	1018.0
DISW3	47.1N	090.7W	0743	-1.6					12.4	SW	34.5	24 03	1014.1
DPIA1	30.3N	088.1W	0733	15.8	16.6				11.6	SE	31.0	28 07	1017.3
DRYF1	24.6N	082.9W	0743	22.7					10.8	E	29.3	03 08	1016.7
DSLN7	35.2N	075.3W	0742	13.3	15.2	1.8	7.4	02 23	19.7	NE	57.7	02 19	1015.3
FBIS1	32.7N	079.9W	0743	15.7					9.5	SW	27.1	02 14	1015.3
FFIA2	57.3N	133.6W	0743	4.1					13.4	SE	34.0	13 05	1010.7
FPSN7	33.5N	077.6W	0677	16.7		1.7	6.9	02/17	19.0	S	50.3	02 15	1014.7

January, February and March 1994

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA HR)	MEAN PRESS (MB)
FWYF1	25.6N	080.1W	0738	22.8	24.0				18.6	NE	27.7	01 15	1016.9
GDIL1	29.3N	090.0W	0741	16.9	18.6				10.6	SE	28.6	28 07	1016.8
GLLN6	43.9N	076.5W	0743	-1.6					11.1	W	34.5	08 21	1012.7
IOSN3	43.0N	070.6W	0742	1.4					13.2	NW	40.5	03 17	1010.6
LKWF1	26.6N	080.0W	0743	21.8	23.8				11.7	SE	29.4	02 09	1017.0
LONF1	24.9N	080.9W	0743	22.9	24.2				11.0	NW	30.9	03 11	1016.6
MDRM1	44.0N	068.1W	0743	1.1					16.9	W	46.1	03 22	1009.7
MISM1	43.8N	068.9W	0743	0.8					16.2	NW	47.2	03 19	1010.3
MLRF1	25.0N	080.4W	0744	23.0	24.3				12.1	SE	34.4	02 21	1016.0
NWPO3	44.6N	124.1W	0589	9.0					10.8	S	42.2	21 01	1018.7
PILM4	48.2N	088.4W	0740	-2.5					12.8	W	32.3	07 13	1015.0
PTAC1	39.0N	123.7W	0738	10.6					8.6	N	25.4	24 02	1018.9
PTAT2	27.8N	097.1W	0738	17.4	17.9				11.6	SE	26.8	16 12	1015.9
PTGC1	34.6N	120.7W	0711	12.4					13.7	N	37.0	22 16	1016.9
ROAM4	47.9N	089.3W	0742	-2.2					14.6	SW	34.5	15 11	1014.8
SANF1	24.5N	081.9W	0742	22.9	23.8				11.8	NE	33.4	02 20	1016.5
SAUF1	29.9N	081.3W	0743	17.3	17.2				10.1	W	24.9	11 15	1016.4
SGNW3	43.8N	087.7W	0744	0.5	1.5				9.7	W	26.5	24 18	1016.2
SISW1	48.3N	122.9W	0741	7.8					10.7	W	43.3	20 22	1018.2
SMKF1	24.6N	081.1W	0742	23.2	24.4				12.7	SE	41.3	02 20	1017.0
SPGF1	26.7N	079.0W	0744	22.7	24.9				8.9	E	30.9	03 16	1017.1
SRST2	29.7N	094.1W	0676	15.9					10.3	SE	27.7	09 09	1016.8
STDM4	47.2N	087.2W	0743	-2.5					15.8	W	40.6	08 00	1013.3
SUPN6	44.5N	075.8W	0743	-1.9	3.9				7.8	SW	27.1	22 07	1012.7
SVLS1	32.0N	080.7W	0728		15.8	0.8	2.0	02 17	15.4	S	32.4	03 15	1015.7
THIN6	44.3N	076.0W	0743	-1.8									
TPLM2	38.9N	076.4W	0741	5.7	4.7				11.8	NW	34.0	02 21	1014.4
TTIW1	48.4N	124.7W	0740	7.9					15.6	E	61.1	21 10	1018.0
WPOW1	47.7N	122.4W	0741	8.4					9.2	S	37.2	21 08	1018.7

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Coast Guard Communication News

NEW COAST GUARD RADIOTELEPHONE SERVICE

Coast Guard Group Moriches in Long Island, New York, and Coast Guard Communications Station NMF in Marshfield, Massachusetts, began offering a new radiotelephone service to mariners on a trial operational basis as part of the new Global Maritime Distress and Safety System. This new service, called digital selective calling (DSC), will allow mariners to instantly send an automatically formatted distress alert to the Coast Guard or other rescue authority anywhere in the world. Digital selective calling will also allow mariners to initiate or receive distress, urgency, safety and routine radiotelephone calls to or from any similarly equipped vessel or shore station without requiring either party to be near a radio loudspeaker. We have also begun announcing unscheduled marine information broadcasts from both Moriches and Marshfield using this service.

Group Moriches will receiving VHF maritime DSC calls on VHF channel 70 and Medium Frequency DSC calls on 2187.5 kHz. Urgent marine information broadcasts on VHF channel 22A and 2670 kHz will be preceded by a DSC call. This prototype system will be operational for a one-year trial period starting 1 March 1994. The DSC identification number for Group Moriches is 003669985.

Communications Station NMF has been receive Medium and High Frequency DSC calls on 2187.5, 4207.5, 6312, 8414.5, 12577, and 16804.5 kHz from mariners for several months. Urgent marine information broadcasts on 2670 kHz will be preceded by a DSC call. The DSC identification number for Communications Station NMF is 003669991.

The Coast Guard plans to install this service at each of its high seas communications stations by next year and at each of its coastal radio stations by the end of the decade. Marine radios equipped with this digital selective calling feature is just now becoming available and should be standard on most if not all marine radios sold in the U.S. within about four years. We expect this service to eventually replace a listening watch on most maritime radio voice channels.

We encourage you to test this system and give us your comments. If desired, special tests can be arranged directly with the Group or the Communications Station.

FEDERAL COMMUNICATIONS COMMISSION REGULATORY FEES

The Omnibus Budget Reconciliation Act of 1993 required the Federal Communications Commission to collect an annual regulatory fee for Private Radio Bureau shared use licenses. Effective 16 July 1994, the cost for a new or renewed FCC Ship Station License will increase by $70, making the minimum total cost $105. Licenses are required on any boat of ship carrying a marine radio, emergency position indicating radiobeacon (EPIRB) or radar.

RADIO WATCH REQUIREMENT

Federal Communications Commission regulations require that ALL vessels required to carry a VHF marine radio MUST maintain a radio watch on channel 16 (156.8 MHz), except under specific circumstances, while the vessel is underway (47 C.F.R. 80.148). Included in this requirement are all U.S. uninspected commercial fishing vessels, fish processing vessels and fish tender vessels that operate beyond the Boundary Lines or that operate with more than 16 individuals on board.

The purpose of this regulation is threefold. First, it helps ensure that calls from a vessel in distress will be received by ships which may be in position to give immediate assistance. Second, it helps ensure that storm warnings and other urgent marine information broadcasts are received. The Coast Guard announces these broadcasts on VHF channel 16. Third, it will enable vessels to successfully handle situations where risk of collision exists, particularly in areas where the Bridge-to-Bridge Act does not apply.

INCREASED NORTH ATLANTIC RADIOFAX BROADCAST SERVICE

U.S. Coast Guard Communiocations Station Boston/NMF has significantly expanded its broadcast of National Weather Service weather charts and has changed radio frequencies in order to provide more reliable cover-

age. Simultaneous radiofacsimile broadcasts are now made on 6340.5 kHz and 12750 kHz.

COAST GUARD RADIO INFORMATION AVAILABLE ON COMPUTER BULLETIN BOARD

The Coast Guard Navigation Center (GPS Information Center) computer bulletin board system now includes information on Coast Guard radiocommunications systems, including radio frequencies and schedules used for broadcast of high seas maritime safety information, and receipt of distress and safety calls from the mariner. Specific information includes:

General Radiocommunication Information
Distress Watchkeeping Schedule
HF Voice Broadcast Schedule
HF Radiofacsimile Broadcast Schedule
HF Telex Broadcast Schedule
International NAVTEX Schedule
Inmarsat C SafetyNET Schedule
New and Changed Services

The BBS system also includes local notices to mariners, and information concerning LORAN C, OMEGA, GPS and differential GPS radionavigation systems, location and status.

Anyone may use the BBS system; there's no charge. The BBS can connect at all common modem speeds from 300 to 14,400 bps, and uses the common 8N1 setting (8 data bits, 1 stop bit, No parity).

Dial 703 313-5910 and follow instructions to register on line. New users have all standard user privileges immediately upon registration. Information is provided via a menu-driven interface with context-sensitive help. An online users manual is also available for download. Callers who have Remote Imaging Protocol (RIP) graphics can operate most BBS features via a mouse driven point-and-click interface. Callers can obtain RIP by downloading a RIP terminal program for DOS at no charge. Up to 17 callers can use the BBS at a time. Call 703 313-5900 (voice) for assistance, anytime.

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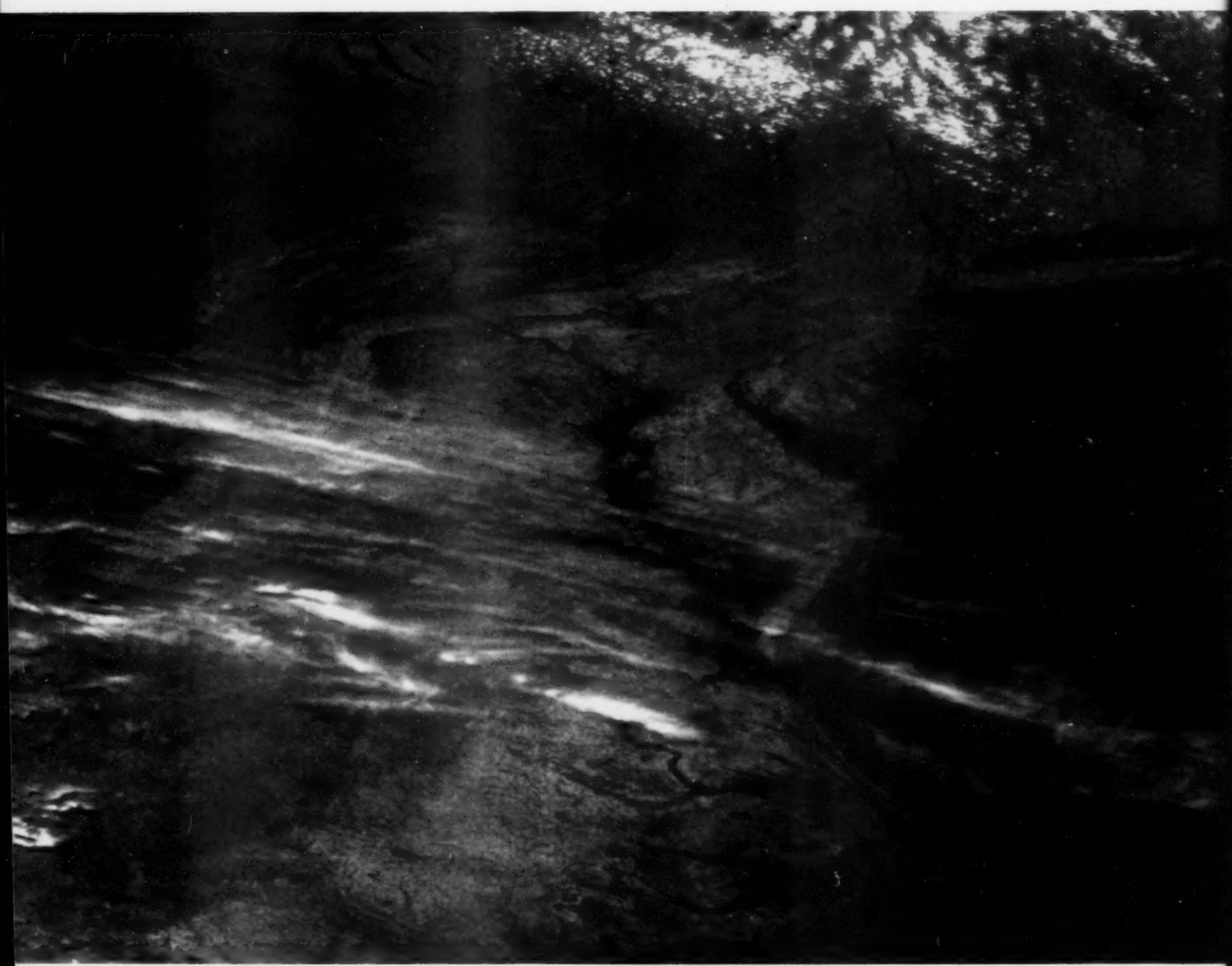

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